MEMORANDA

ON SOME

MEDICAL DISEASES

IN THE

MEDITERRANEAN WAR AREA

WITH SOME SANITARY NOTES

Basra.
Sept. 1916.

Corrected and Revised
Copy with numerous additions.
A.B.

[Revisions in Dr Bulfont's hand]

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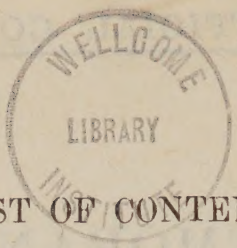

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Beri Beri.
Bilharziasis

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CEREBRO-SPINAL FEVER.

This disease has occurred at Salonica within recent years. In hot, dry and sandy countries it is apt to appear in the season when dust-storms are prevalent.

Etiology.

The causal micro-organism is the Gram-negative *Diplococcus intracellularis* of Weichselbaum found in the cerebro-spinal fluid and meninges of persons suffering from the disease. It has been isolated from the blood and from the nasal and lachrymal secretions and is frequently demonstrable in the throat secretions of contact cases. It would seem that the healthy "carrier" is the chief source of infection and, harbouring the meningococcus in his throat, he distributes it when he coughs, spits or sneezes. Infected fomites, such as handkerchiefs, etc., may play a part and it is possible that food may become contaminated and infection take place through the gastro-intestinal tract. The general view is that it enters the brain either viâ the lymphatics through the cribriform plate of the ethmoid or the sphenoidal sinuses, or reaches brain or spinal cord by the blood through the respiratory passages.

Observations on a regimental epidemic showed that :—

1. There are many more contacts than actual cases.
2. The cocci usually disappear quickly from the naso-pharyngeal mucus but may persist for 4 weeks.
3. They are most numerous and virulent during their first week of residence in the throat.
4. They are little resistant to the sun's rays.

The prevalence of naso-pharyngeal catarrh favours infection and so do over-fatigue, over-crowding and bad ventilation. It is conceivable that under war conditions flies might spread infection. The whole of the "carrier" question is still *sub judice.*

Symptoms.

Incubation period uncertain but probably less than 10 days. The onset is very sudden, so much so that the patient may rapidly lose consciousness. If he can walk his peculiar gait may betray him for he looks as if he were going to throw himself backwards. He complains of headache, stiffness in the neck and chilly sensations. There may be a rigor and vomiting and the temperature is raised. The face is flushed, the mind confused, the patient possibly delirious. Retraction of the head is marked. It may be difficult to bend it forward. Herpes on the lips or elsewhere is common. The tongue is dry and furred. Strabismus may be noted and photophobia is frequent. The presence of Kernig's sign is a great help in diagnosis for it is rarely absent. Petechiæ, a patchy erythema and purpuric blotches appear on the skin in some

of the more severe cases—hence the name "Spotted Fever" but the exanthem is not very frequently seen. It may be in the form of pink spots like those of typhoid but not raised. Look for these on the back and about the joints. Lumbar puncture shows an opalescent, milky spinal fluid which contains the organism. In bad cases the delirium may be violent and if the patient is going to die respiration becomes laboured, the face cyanosed, and a purulent discharge pours from the nostrils. The termination is by hyperpyrexia or sudden collapse. Symptoms often vary greatly from day to day and hence the prognosis must be guarded. Cases may recover completely or pass into the chronic wasting stage which will not be here considered.

There are ambulant, abortive, septicæmic and fulminant types. The two former are apt to escape detection. Relapses are apt to occur.

Complications.

Inflammatory conditions of the eye and ear are the most important. Acute nephritis must also be mentioned.

Diagnosis.

The bacteriological diagnosis of the spinal fluid is very important. The technique for lumbar puncture is as follows :—Patient on side near edge of bed, knees well drawn up, head and shoulders thrown forward. See that there is a good light on the back and that no shadow falls on the operator's hand. After painting the skin patch with iodine and steadying the patient, thrust a long, sterilized needle with large bore into the intervertebral space which is on a level with a line touching the summits of the iliac crests and is between the fourth and fifth lumbar vertebræ. Fig. 1. It should be entered about three-eights of an inch to the right or left of the middle line and directed upwards and inwards. Puncture can also be made in the middle line, the needle pointing slightly upwards. The canal is reached at a depth of from one to three inches. According to the amount of intra-spinal pressure the fluid will exude in drops or in a continuous stream. It is turbid in the acute stage. Care must be taken that it does not squirt on to attendants.

If the fluid does not flow the patient may be asked to cough as this will sometimes start its expulsion. It may be allowed to escape till the rate of flow is about one drop to each 3 or 4 seconds. A blood examination will show polymorphonuclear leucocytosis.

Differential Diagnosis.

In the Mediterranean war area distinguish especially from typhus fever, relapsing fever, malaria, typhoid fever, rheumatic fever, influenza and heat-stroke. Other diseases to be borne in mind are plague, early small-pox, a certain form of scarlet fever with nervous manifestations, meningitis due to pneumococcal infection, chronic nephritis with uræmia, acute mania, acute irritant poisoning and hysteria simulating meningitis.

Quite recently disinfection of the naso-pharynx by the 2 per cent ~~chlor~~ chloramine has been advocated. This method is now on its trial.

Prophylaxis.

Avoid unnecessary fatigue and guard against overcrowding, faulty ventilation of quarters and barracks and the conditions giving rise to nasopharyngeal catarrh. It is probably advisable to destroy foodstuffs found in infected premises and to distribute formamint lozenges, if available, to those likely to be or to become carriers. Such men may also with advantage use a nasal wash of sodium salicylate, 10 grains to the ounce of water, night and morning. Actual carrier cases should be treated by being made to sniff up a solution of 1 in 1000 potassium permanganate plus 1–5 per cent. sodium sulphate to assist penetration, or their naso-pharynx may be sprayed with a one per cent. solution of iodine combined with a two per cent. solution of menthol in paroleine. A swab of 3 per cent. iodine in glycerine can be used and an alternative method is that employed in the French army, the following mixture being prescribed for inhalation :—

Iodine	...	...	...	12 grammes.
Guaiacol	...	...	...	2 ,,
Thymol	...	...	...	25 centigrammes.
Alcohol, 60 per cent.			...	200 grammes.

Note.—In order to dissolve the iodine, 6 grammes of iodide of potash should be added to the above.

This mixture is put in a porcelain dish, which is floated in a basin of boiling water. The patient is directed to sit with his head bent over this at a few inches distant and inhale the fumes, breathing slowly through each nostril; the sitting should last for two or three minutes, and should be repeated five times in twenty-four hours.

All cases of unaccountable headache, of apparent ptomaine poisoning, and of vomiting, with or without rise of temperature or pulse, as well as all cerebral cases, should be isolated and notified. When the patient is diagnosed to be suffering from epidemic cerebro-spinal meningitis he should be immediately sent to the isolation hospital, and not only his bedding but that of all his immediate neighbours and their blankets and clothing should be sent for disinfection. All the men sharing his room or hut should be isolated from the first and kept under special observation for signs of the disease, swabs being taken from them by an officer deputed for the purpose. Not until these swabs prove to be negative should the house or hut be pronounced free from infection, until when no man in it should be allowed to return to duty. The isolation should be real, and the men drilled and paraded apart from the rest of their unit, and no direct inter-communication should be allowed between them and the cookhouse, while all feeding utensils should be swilled out with boiling water, and every man should use his own cups and plates. All waste matter should immediately be destroyed by fire, and special latrine arrangements made for the use of contacts. Systematic destruction of lice and fleas should be undertaken, and samples of vermin collected alive for investigation. Further, provision should be made for the isolation

of carriers, through whose instrumentality, it seems certain, some of the outbreaks have arisen.

One may add that in the Mediterranean war area patients should be protected from flies by head nets or mosquito nets.

In swabbing the throat the important thing is to get well in behind the soft palate. An ordinary diphtheria swab turned up at the end answers excellently.

Treatment.

Provided a reliable product can be obtained, and this is all-important, the intrathecal or, in septicæmic cases, intravenous injection of anti-meningococcic serum prepared according to Flexner's method is undoubtedly the best procedure. Puncture is performed in the manner already described but the patient's hips should be raised on a firm bolster or cushion and the foot of the bed elevated at least a foot. The ordinary injection syringe may be used with a piece of flexible rubber tubing interposed between the nozzle and the needle or the serum may be introduced by gravity by means of a funnel and rubber tube with a clip. The serum, which in all cases should be warmed to body-heat by immersion in hot water, is poured into the funnel and tubing and the latter is then attached to the needle prior to loosening the clip. The maximum height to which the tube end of the funnel should be raised is 18 inches.

Before injection a certain amount of spinal fluid is allowed to escape. Recent work seems to show that this should not exceed 90 c.c. at any one time and the flow should be stopped if there is any indication of negative pressure being established. This loss of fluid is in itself often markedly beneficial but it is wise in all cases to give the serum. Hence replace the stylet in the needle until one is ready to inject the serum. A good plan is to measure the amount of fluid removed and then to replace it by a proportional quantity of serum. Thus if 60 c.c. of fluid is obtained 40 c.c. of serum is given. The injection should be made very slowly and steadily, allowing at least one minute for each c.c. of serum injected. As a rule 20 to 30 c.c. are given as a first injection. Maintain the patient's position in bed for an hour after the administration.

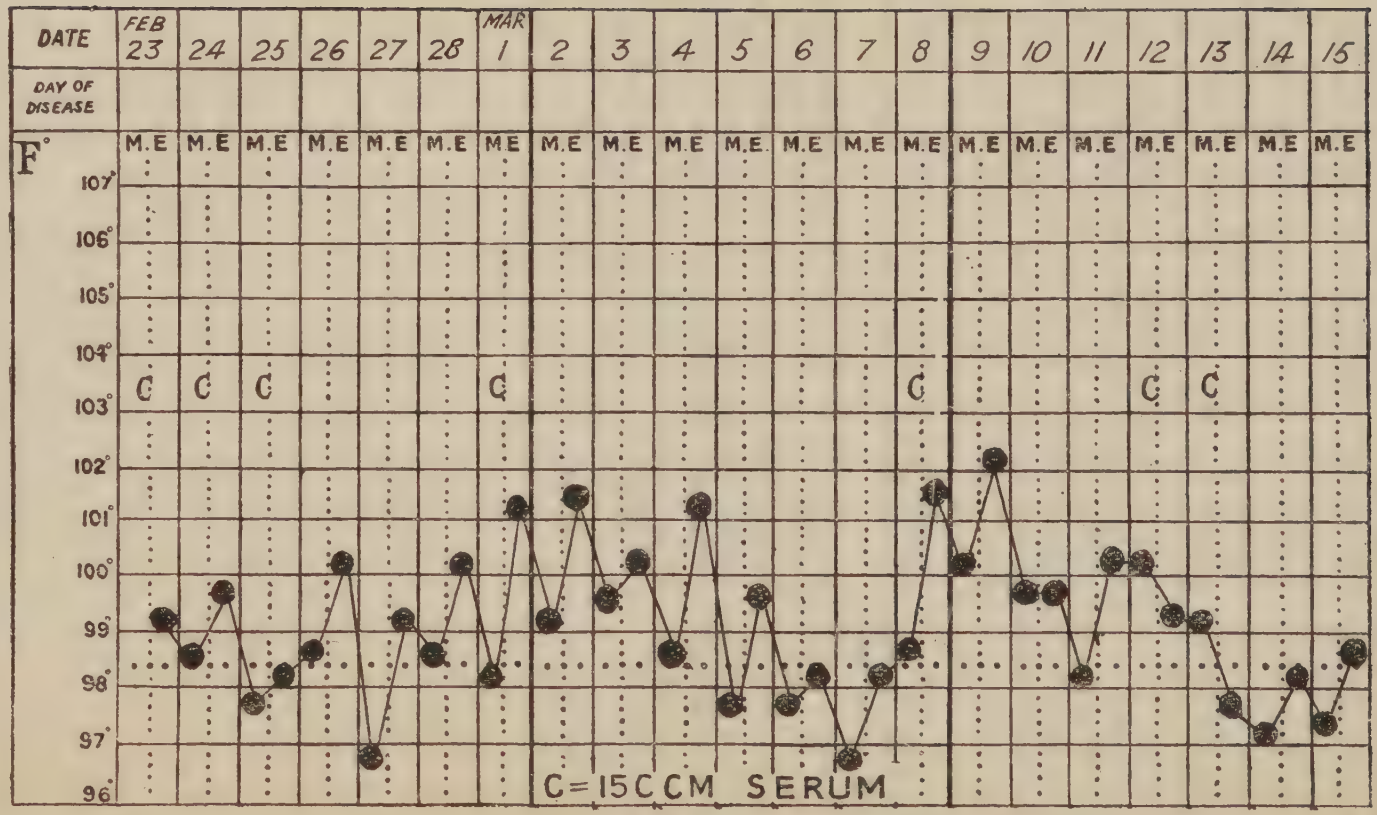
Local anæsthesia with ethyl chloride spray is usually considered sufficient for the operation but some recommend general anæsthesia where the patient is not unconscious, as sometimes both the withdrawal of fluid and the injection of serum occasion intense pain. If the spray is used the possibility of the needle getting choked by a plug of frozen skin must be borne in mind. Slight and careful suction with the syringe may sometimes be required to induce the spinal fluid to flow. If the patient is made to suck water through a straw during the operation the pain appears to be made more bearable and the patient less restless. Post-operative pain is best controlled by the local application of a hot poultice or fomentation.

If signs of collapse ensue stop the injection. Should the temperature rise after the operation sponge the patient or cool him by cradling the bed-clothes. As a rule after the injection the restless patient becomes calm and may fall asleep. The question of repeating the injection must be determined by the gravity of the case. As a rule daily doses of 15 to 20 c.c. are given for 3 or 4 days, then after a three-days interval another injection is given and yet others if considered necessary. A good rough guide is the state of the spinal fluid. If it remains turbid it is well to give more serum. The real guide is the number of extracellular meningococci found. The persistence of Kernig's sign and continued spiking of the temperature are other indications. If on account of œdema the second puncture is found difficult it may be made in the space between the third and fourth lumbar vertebræ. Fig. 1.

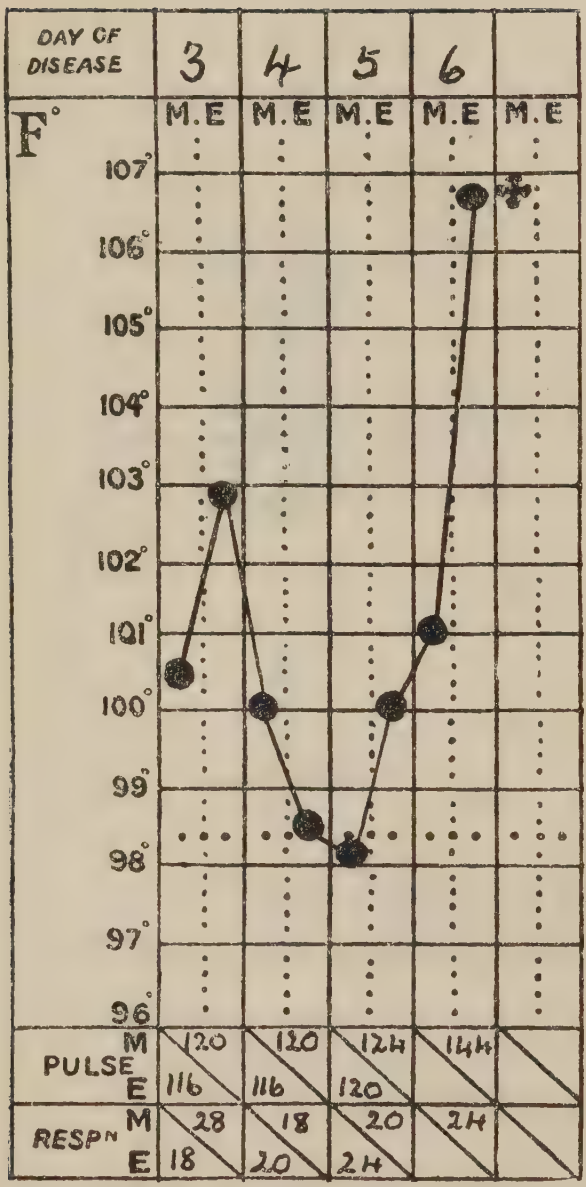
Failing serum, soamin may be given intramuscularly or intravenously. By the former route 5 grains is the usual initial dose, given for two days and then reduced to 3 grains every second day. For intravenous administration the dose is 3 grains. Vaccine therapy is on its trial.

In all cases of cerebro-spinal fever the possibility of retention of urine must be borne in mind. The symptomatic treatment must not be neglected, such as hot baths for pain and restlessness, ice to the head or antipyrin, caffeine or aspirin for headache and valerian and the bromides for insomnia and delirium. Morphia is better avoided but may have to be given in cases of intense pain. The foul mouth should be treated in the manner described under Typhus Fever. A mixture of glycerine and lemon juice as an oral swab is grateful and comforting.

Mercury and the iodides have been given on general principles.

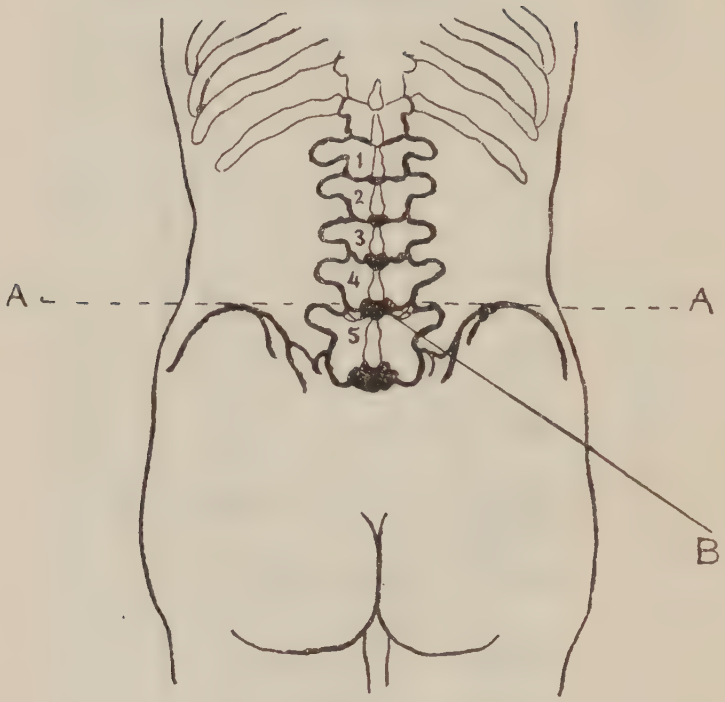


CASE OF CEREBRO-SPINAL FEVER TREATED BY SERUM.



FATAL CASE OF CEREBRO-SPINAL FEVER.

Fig. 1.



AA. The Intercristal Line.

B. Space of Election for Lumbar Puncture.

CHOLERA.

Happily at the time of writing no cases of cholera have been reported in the Mediterranean Expeditionary Force and, although cholera, like other epidemic diseases, is apt in time of war to transgress the usual laws of epidemiology, it is unlikely that it will break out in the winter season. With the advent of warm weather, however, and the extension of the campaign to Bulgaria, it is more than likely that Asiatic cholera will appear in the war area.

Cholera is caused by the comma-shaped, single-ciliated, Gram-negative vibrio of Koch, which lives, multiplies and produces an endotoxin in the small intestine. The cholera poison causes desquamation of the intestinal epithelium and the other manifestations of the disease.

Research work has shown that under war conditions the cholera "carrier" is undoubtedly the most important factor in spreading infection, but the rôle of water, food, fomites, flies and faulty conservancy methods must also be kept in mind. Vibrios have been found in the fæces of flies for 24-36 hours after ingestion of infected material by the insects.

Cholera vibrios often disappear from the fæces of patients in 3 or 4 days and rarely persist in them for longer than 20 days, but the healthy cholera carrier may go on passing vibrios for a period of 2 months, a gall bladder infection having become established. As a rule, however, the carrier only excretes vibrios for a week or ten days. An attack of diarrhœa or the administration of a purgative will often cause vibrios to appear in the stools of a carrier case and a purge may even excite an attack of cholera in a carrier. In India cholera vibrios have been known to live as long as 17 days in stools kept in the dark and with evaporation prevented. The average time of survival is shorter in hot weather—in June 1-2 days, in February 7 ·7 days (Greig).

Symptoms.—Incubation period a few hours to 5 days. Stages: Those of Evacuation, Algidity and Reaction. In a certain number of cases there is a premonitory diarrhœa, which is probably catarrhal in nature and may predispose to the choleraic attack. In other cases the stage of evacuation commences suddenly with profuse and frequent diarrhœa which may or may not be associated with colic. Indeed a sense of relief may accompany the passage of the stool. The motions, at first fæculent and bile-stained, quickly assume the typical rice-water appearance, there being small white flocculi of intestinal epithelium in a slightly opaque fluid. Pints of this material may pour from the patient, who rapidly becomes prostrated. He begins

to vomit and suffers greatly from thirst. The vomited matter which consists at first of food soon changes to rice-water fluid, and gushing from the mouth is apt to contaminate attendants. Cramps of the legs and abdomen set in, the tissues shrink, the eyes become sunken, the nose pinched, the skin cold and dusky or earthy in hue, the pulse feebler and the urine less. In the initial stages the brilliant white pearly colour of the eyelids, especially of the lower lid, makes the eyes appear large and bright.

Algid Stage.—The serious symptoms become intensified. The skin of the fingers shrivels (washerwoman's fingers) and the nails may become black. The voice is husky. The body surface is cold, livid and bedewed with a clammy sweat. The pulse at the wrist may almost vanish, and if a vein be incised only a drop of black and tarry blood may slowly exude. This concentrated blood has a specific gravity of 1072 to 1078. The kidneys cease to act. The patient is restless, very thirsty and may or may not continue to be racked by cramps. While the surface temperature is low that of the rectum is often elevated.

The mind is clear but the patient is apathetic. In fatal cases and usually some ten to twelve hours after the beginning of the attack coma supervenes, leading to death, but fatal collapse may occur much earlier or much later. The algid stage may terminate in recovery, the pulse returning at the wrist, the skin becoming warm, urine being secreted and convalescence established in a short time. More frequently the patient enters upon the—

Stage of Reaction.—The favourable symptoms just mentioned appear and continue, the motions diminish and now contain bile. At the same time a febrile condition manifests itself, of which the sole indication may be a blood-shot state of the eyes. The febrile manifestation may be slight or severe and in the latter case a typhoidal condition may ensue, which may last as long as a fortnight. During this stage of reaction the patient may die from pneumonia, enteritis, diarrhœa, hyperpyrexia or uræmic poisoning.

Such is a picture of cholera gravis, but on the one hand mild ambulant cases occur where the carrier is a special danger, and on the other there is fulminating cholera in which toxæmia causes rapid death before vomiting or diarrhœa have time to set in. Of this nature is the so-called cholera sicca apt to occur amongst debilitated troops. In the late Balkan war rice-water stools were sometimes absent even in severe cases of cholera.

Diagnosis.—It is beyond the scope of this section to deal with the bacteriological diagnosis of cholera, but it is well to remind the medical officer that in the case of suspected carriers who

are constipated, rectal swabs should be sent to the nearest laboratory, while in the case of an autopsy on a suspected case of cholera 2 five-inch sections of the small intestine, one taken just above the ileo-cæcal valve and the other from the middle of the ileum should be cut out after double ligaturing, placed in sterile, well-stoppered bottles and submitted to the bacteriologist as quickly as possible. If culture media are available an agar or blood serum slant should be made from the material at the same time, as the vibrios are apt to be killed by the fæcal bacteria.

Convalescents from cholera may, it is stated, be recognised by the fact that they present an easily compressible pulse together with a black coating of the middle third of the posterior portion of the tongue. This is most marked about the 7th or 8th day of convalescence and may aid in the detection of cholera cases.

Differential Diagnosis.—Many cases of cholera in the late Balkan war were diagnosed as bacillary dysentery, and it must be remembered that the serous form of the latter may closely simulate cholera. Further, recent work has shown that amœbic dysentery may sometimes do likewise. It is said that if dysentery coexists with cholera, cramps and rice-water stools may be absent. There is a form of pernicious malaria which presents choleraic symptoms, but the high axillary temperature should help to distinguish it from cholera.

Severe diarrhœa of the cholera nostras form, ptomaine and mushroom poisoning, irritant metallic poisoning and the early stages of trichinosis need merely be mentioned. Note that in ptomaine poisoning the vomiting usually *precedes* the diarrhœa.

Prophylaxis—Personal.—Anti-choleraic inoculations are now practised. These would seem not only to afford a considerable degree of protection but to lessen the risk of a fatal issue in the inoculated. The usual dose of the vaccine is 6,000 million bacilli given in two inoculations at 7 or 10 days interval, the first of 2,000 million in 0·5 c.c., the second of 4,000 million in 1 c.c. Where feasible a third dose of 1 c.c. may be given with advantage. The local reaction is very slight and there is rarely any general disturbance. The duration of the immunity produced does not seem to be great and the inoculation should be repeated after the lapse of 4 months.

Although some condemn the practice as being apt to upset the stomach, the use of lactic acid in tea or the addition of 30 drops of dilute hydrochloric acid to every ounce of drinking water has much to commend it. The latter method has recently been used in India, to all appearance with great success. Ten drop doses of eucalyptus oil given twice daily have been strongly recommended. Give in mucilage and syrup of lemons.

When possible all indigestible diet should be avoided. Special care is needed as regards fruit and raw vegetables. Lettuces and celery being moist and eaten uncooked are specially dangerous. Vibrios have been found to survive on lettuce leaves for 29 days. Melons and cucumbers must be eschewed.

Those who handle patients or corpses should wear india-rubber gloves, and doctors, nurses and orderlies should be provided with overalls and gum boots. In any case the careful disinfection of the hands coupled with the use of a stout nail-brush is very important. The practice of hand-shaking should be discouraged during cholera epidemics.

Prophylaxis—General.—Isolation of contacts and search for carriers, whether healthy or suffering from diarrhœa. In all cases more than one bacteriological examination of the stools should be made. Remember that the use of purgatives may induce cholera in a carrier case. Healthy carriers do not seem to be very dangerous.

Cholera patients must be isolated and protected from flies. The closest attention must be paid to the minutiæ of camp hygiene, especially the protection of food from flies, cock-roaches and ants. Food such as milk which has been sterilised may become infected after it has cooled. A strict supervision of cooks and cook-houses is essential. Indeed it would be well, where facilities exist, to have all cooks and handlers of food bacteriologically examined to see that they are not carriers. Certainly any suffering from diarrhœa should be so examined Cook-houses and places where food is stored should be frequently cleansed with soda and hot water.

The disinfection of pottery and table utensils is important. Pottery before being used may be washed in spirit and then sterilised by burning. Table utensils, when they cannot be boiled, may be immersed in a 20 per cent. solution of carbonate of soda at a temperature of 50° C. or in alcohol at 60° C. for half-an-hour. A careful eye should be kept on kitchen cloths of all kinds. They should be washed in permanganate solution.

All water and milk should be boiled. Although there is no fault to be found with the method if properly carried out, chlorination of water is apt to be imperfectly performed, and hence in the presence of cholera it should not be relied upon by the individual. At the same time this process of water sterilization should be continued and in many places it will be the only method available on a large scale. Its careful supervision is most necessary. The acid sulphate of soda tablets are quite efficient and may be safely used so long as they do not upset the digestion. The pocket "chlorine" outfit, if properly em-

ployed, will also render water safe. Remember that, just as in the case of milk, water may become contaminated after sterilization. Hence, after boiling, it should be drunk as soon as it has cooled, unless indeed it is carried in a closed and properly disinfected water bottle. Water bottles should be disinfected by permanganate of potash and this should also be employed for the "pinking" of shallow wells, one ounce per 2,000 gallons of the well water being sufficient.

Disinfect cholera stools by adding an equal amount of a 5 per cent. cresol solution and allowing it to remain in contact with the stool for at least one hour. Fresh chlorinated lime 1 lb. to 4 gallons may be used in the same way. Roughly 2 tablespoonfuls to the pint of cholera dejecta are required.

Nothing is better than quicklime if it can be obtained. Add together equal parts of fresh quicklime and water. Dilute with three times as much water as previously used. Add a quantity of this slaked lime equal to the amount of stool to be disinfected and allow to remain in contact for 1 hour. When ground has been fouled by dejecta or vomit disinfect with cresol or rake hot ashes over it or pour kerosene oil upon it and set the latter alight.

Cholera-soiled clothing, bed linen and blankets should be stoved or soaked in a $2\frac{1}{2}$ per cent. cresol solution.

No washing must be allowed near wells and bathing-places require inspection and regulation.

Treatment.—For the most part drugs are of little use in cholera. The Indian practice is to treat the premonitory diarrhœa by giving half an ounce of castor oil with a teaspoonful of brandy. This is probably wise as it clears the bowel of irritating material.

Five minim doses of dilute sulphuric acid in a tablespoonful of cinnamon water every quarter of an hour for 4 doses and then every hour may, after the initial castor oil, serve to check the diarrhœa.

The symptomatic treatment is important. Even in the mildest cases absolute rest in bed is essential, a warmed bedpan being provided. No food is to be given while the disease is active. The surface of the body must be kept warm. A hot mustard bath is indicated if the patient can stand it and should be followed by a vigorous rubbing down. Hot sand-bags to the body are useful and kneading of the muscles to relieve the intolerable cramps. When the latter become unbearable a whiff of chloroform may be given, and an arrangement can be made by means of a mask attached to a rubber band or elastic tape whereby the patient can administer the anæsthetic himself and yet remain safe as the mask is whisked away when he begins to become unconscious.

Ice and a small hypodermic of opium may check the vomiting, but it must be remembered when giving drugs subcutaneously in cholera that they remain unabsorbed during the algid stage, and when the reaction sets in the drug or drugs which have been injected may be taken up in quantities which prove poisonous. Cocain or tincture of iodine may also be tried for the vomiting.

Fluid should be given in sips as large drinks are apt to excite emesis. Stimulants may be necessary. Camphor is useful. Hot red wine, hot tea and black coffee have been recommended.

A method of treatment which has come into vogue during the late Balkan war and which is said to have had a great measure of success is the administration of the so-called " bolus alba," which has also been used in bacillary dysentery. The bolus consists of kaolin, native aluminium silicate powdered and freed from gritty particles. It is insoluble and is given in a dose of 200 grammes (7 ounces) in 400 c.c. (14 ounces) of water. If it is vomited a further dose is given immediately in continual small sips. The effect is almost instantaneous, and it would seem that the kaolin is well-nigh a specific, but further information is required.

The standard treatment for cholera, however, is that of Rogers. It is based on the fact that not only is the water content of the blood reduced by an amount varying from one-third to two-thirds, but there is also a loss of saline constituents. Hence the latter must be supplied, and his hypertonic solution for intravenous injection consists of sodium chloride, 120 grains; potassium chloride, 6 grains; calcium chloride, 4 grains; sterilized water, 1 pint. This is introduced by means of a special apparatus at the rate of not more than 4 ounces a minute.

As a guide to the necessity for the employment of his method Rogers estimates the specific gravity of the blood. As full particulars are given in the booklet accompanying the cholera equipment nothing further need be said regarding the method here. When the equipment is not available normal saline may be used or the emergency transfusion fluid mentioned in the dysentery section. It contains sodium carbonate, and as the latter has a lytic effect on red cells and possibly also a deleterious action on the lining epithelium of the vessel walls it is perhaps better to use the bicarbonate. The amount converted into the carbonate by the sterilization process is negligible.

The other part of Rogers's treatment consists in the administration of calcium permanganate water and 2 grain coated potassium permanganate pills given very frequently at first. Details will be found in the equipment booklet. Continue the pills until the stools become green and less copious. Along with the permanganate 10 minims of a 1/10,000 solution of adrenalin chloride

may be given every 3 hours to re-establish the urinary secretion. Keep the patient warm and apply turpentine stupes to the abdomen. Serum therapy in cholera is still on its trial but promises well. The dose is 40-100 c.c. intravenously.

A useful mixture for the reaction stage is as follows :—

R/	Bismuth salicylat.	gr. 15
	Sod. bicarb.	gr. 5
	Liq. opii sedativ.	m. 5
	Mucilaginis	q. s.
	Aq. chloroformi	℥ i

At this stage also if the diarrhœa is troublesome rectal injections of tannin, 1 ounce; gum arabic, 1 ounce; and warm water, 1 quart, are indicated.

Inquire as to retention of urine and treat anuria by poulticing or dry cupping over the kidneys.

At a later period alkalis and digitalis will be found useful. A serious symptom to be promptly combated is the occurrence of coma. As there is marked acidosis in cholera the method of giving 3 per cent. sodium bicarbonate solution by subcutaneous injection seems reasonable. It may be given frequently in quantities up to one litre.

The diet for convalescent patients must be very bland and easily digested and the return to ordinary diet carefully regulated.

DENGUE.

This disease, also known as Dandy fever and Break-bone fever, occurs in many parts of the world, and is most common along littorals. It occasionally breaks out in Egypt, has been reported from the Gallipoli Peninsula, probably visits the Islands of the Aegean Sea, and is almost certainly found along the coasts of Greece, Bulgaria, and Turkey.

Though there is good evidence to show that the virus is transmitted by mosquitoes, certainly by *Culex fatigans*, and possibly by one or other species of *Stegomyia*, the germ itself is unknown, being apparently an ultramicroscopic organism and a filter-passer which is present in the patient's blood from the 2nd to the 5th day.

Dengue has been conveyed by mosquitoes immediately after their meal of infected blood, but the virus may survive in them for 8 to 27 days.

Symptoms.—Incubation 2 to 5 days. Onset very sudden, with rapid rise of temperature, which may reach 105° F. Within an hour or two the so-called initial rash appears. It may be only a blotchy congestion of the face, or there may be a scarlatiniform erythema, usually confined to the face and extremities. Remember that this primary rash is very transient and is often overlooked. Itching of the palms and soles may occur at the same time. Very soon the patient is suffering from severe headache, chiefly supra- and post-orbital, and the typical joint pains, which are really located in the tendinous insertions about the joints. There is also myalgia, most severe in the back. The condition indeed closely resembles that met with in influenza. The ocular muscles are specially affected, and every movement of the eyes causes pain. The pulse is slightly accelerated but soon slows. Swollen glands may make their appearance. Insomnia is present and there is severe mental and physical depression, while malaise and anorexia are marked. Constipation is the rule at the outset. There is no albuminuria. The temperature remains high for 3 or 4 days, then drops, it may be to normal, continues low for from 12 hours to 3 days, and then rises again sharply. During the interval the patient feels better, but, with the relapse, the pains and other general symptoms start again. This stage, however, is short, but is marked by the appearance of the terminal rash, which may be signalized by a regular crisis with sweating, diarrhoea or epistaxis. Sometimes a crisis of this kind accompanies the first fall of temperature. The true dengue rash resembles that of measles, begins about the bases of the thumbs and the back of the wrists and soon appears about the big toe and ankle. Then the elbows and knees

may be involved, and sometimes the exanthem spreads all over the body. The palms and soles may take on a carmine flush. Desquamation follows when the rash has been pronounced. This second stage may be very brief, or may last for a couple of days.

The disease is very rarely fatal, and then nearly always owing to complications.

Convalescence is apt to be slow and marked by neurasthenic symptoms.

Leucopenia and reduction in the polymorphs constitute the most marked blood changes.

While the above symptoms are those of typical dengue, it must be remembered that there are so-called 6 and 7 day fevers, which, for all practical purposes, may be classed as dengue. In these the typical saddle-back temperature may be lacking, the pyrexial record being continuous, the spleen may be slightly enlarged, and one or both rashes may be absent. It seems advisable to look upon these fevers as cases of atypical dengue and it is well to note their occasional occurrence.

Dengue is very explosive in its outbreak and runs through a community like wildfire, exhausting itself and dying out in a few weeks. It must be differentiated especially from influenza, so-called Mediterranean yellow fever and phlebotomus fever, and, to a less extent from malaria, early enteric or paratyphoid, scarlatina, measles, early smallpox and rheumatism.

The almost invariable respiratory involvement in influenza is a distinguishing feature, while the rash and slow pulse of dengue are absent in influenza.

In Mediterranean yellow fever albumin will usually be found in the urine at an early date, and the spleen is always enlarged.

The presence of a rash and the absence of conjunctival symptoms serve to distinguish dengue from phlebotomus fever, as does the course of the temperature, but the differential diagnosis between these two diseases is not always easy as both may assume atypical forms.

The onset of dengue is different from that of malaria but may resemble the early stage of enteric and paratyphoid (see Chart IV).

Careful observation should, however, serve to distinguish dengue from these fevers and from the other diseases mentioned above.

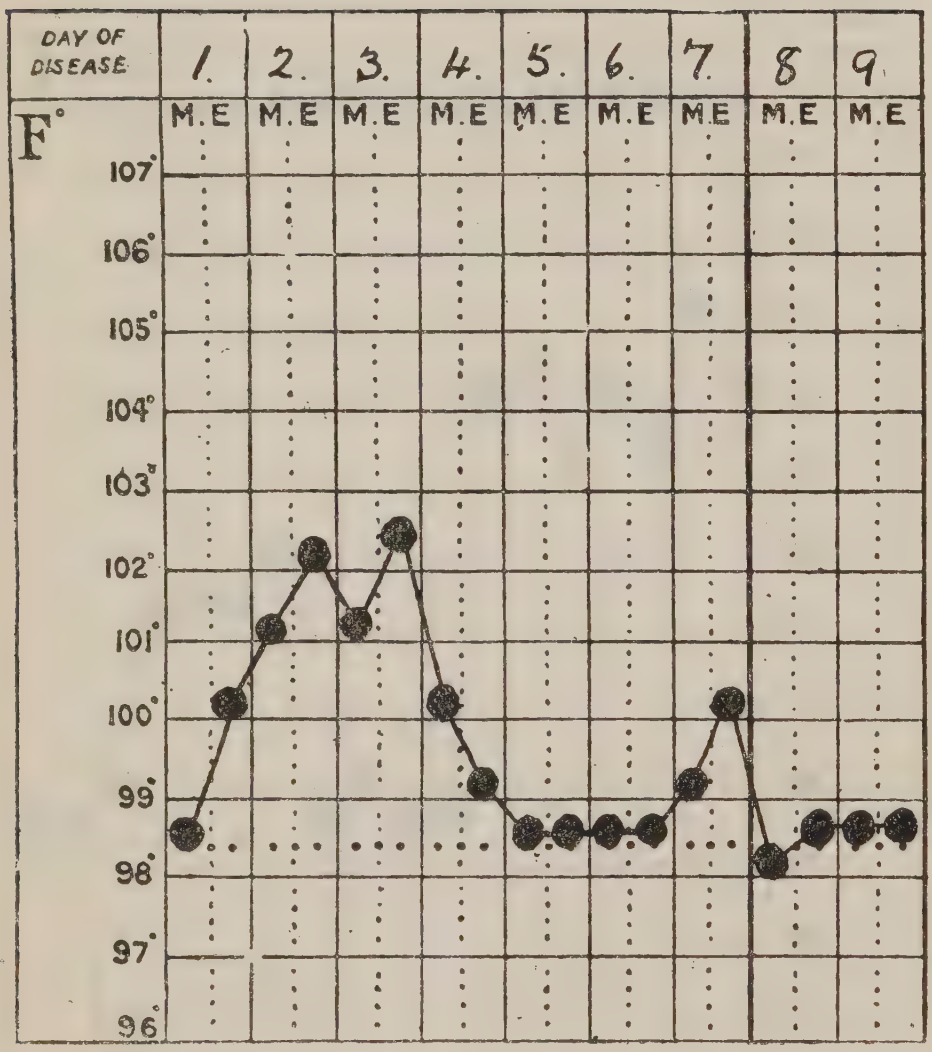
Prophylaxis.—Destroy mosquito breeding places and protect from mosquito bites by repellants, such as one part of oil of bergamot in 16 parts of kerosene, citronella oil in vaseline, 50-per-cent. alcoholic solution of thymol or oil of cloves in lanolin and glycerine. It is said that one ounce of Epsom salts dissolved in half-a-pint of water, dabbed on the skin and allowed to dry, affords good protection. Where possible nets (18 meshes to the linear inch) should be employed.

Treatment.—Light diet. Phenacetin and aspirin for the relief of pain and headache. The non-depressant antipyretic cryogenin, largely used in French practice, may be tried. It is meta-benzamine semicarbazide and the usual dose is 10 to 15 grains.

Morphine is rarely necessary and is better avoided. Cold spongings are useful, especially for the insomnia.

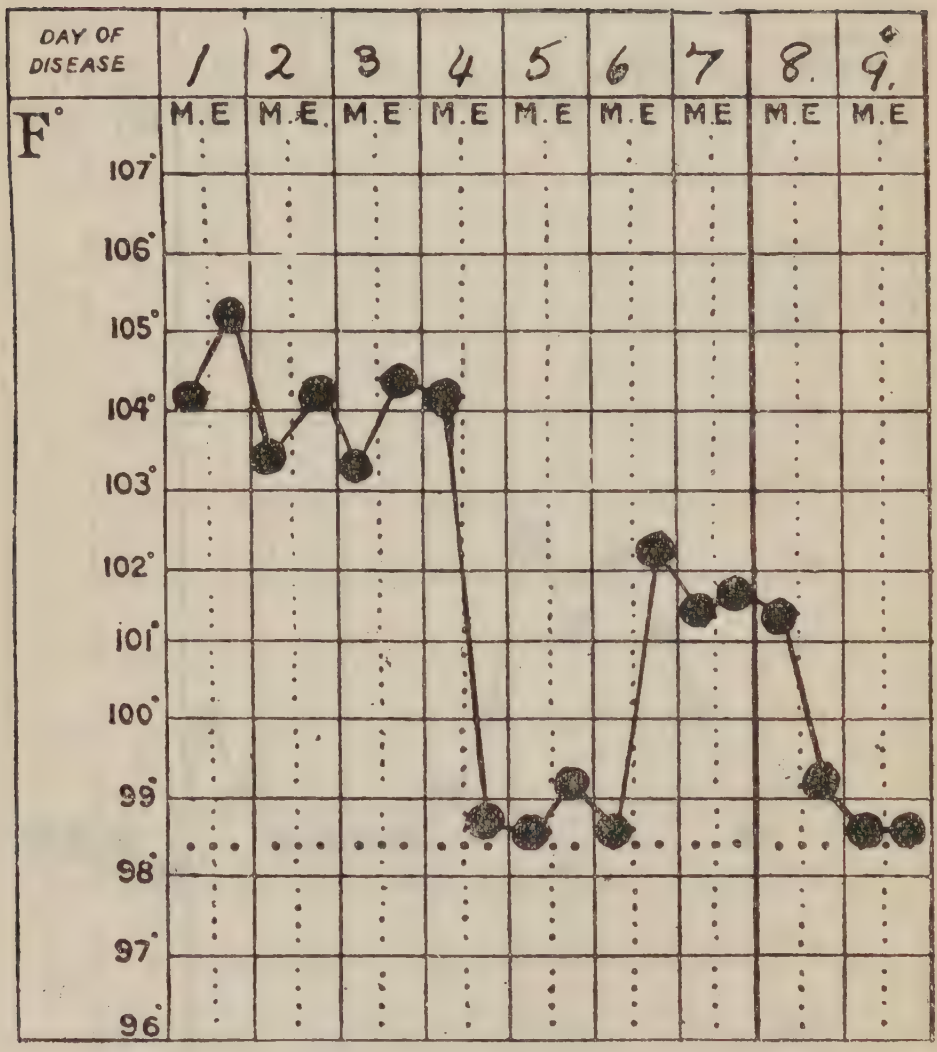
During convalescence, where there is much depression, a sound wine should be ordered. Nothing is better than a good Burgundy. The prolonged asthenia suggests supra-renal insufficiency, and hence adrenalin : 30 minims of a 1—1000 solution by the mouth is indicated.

I.

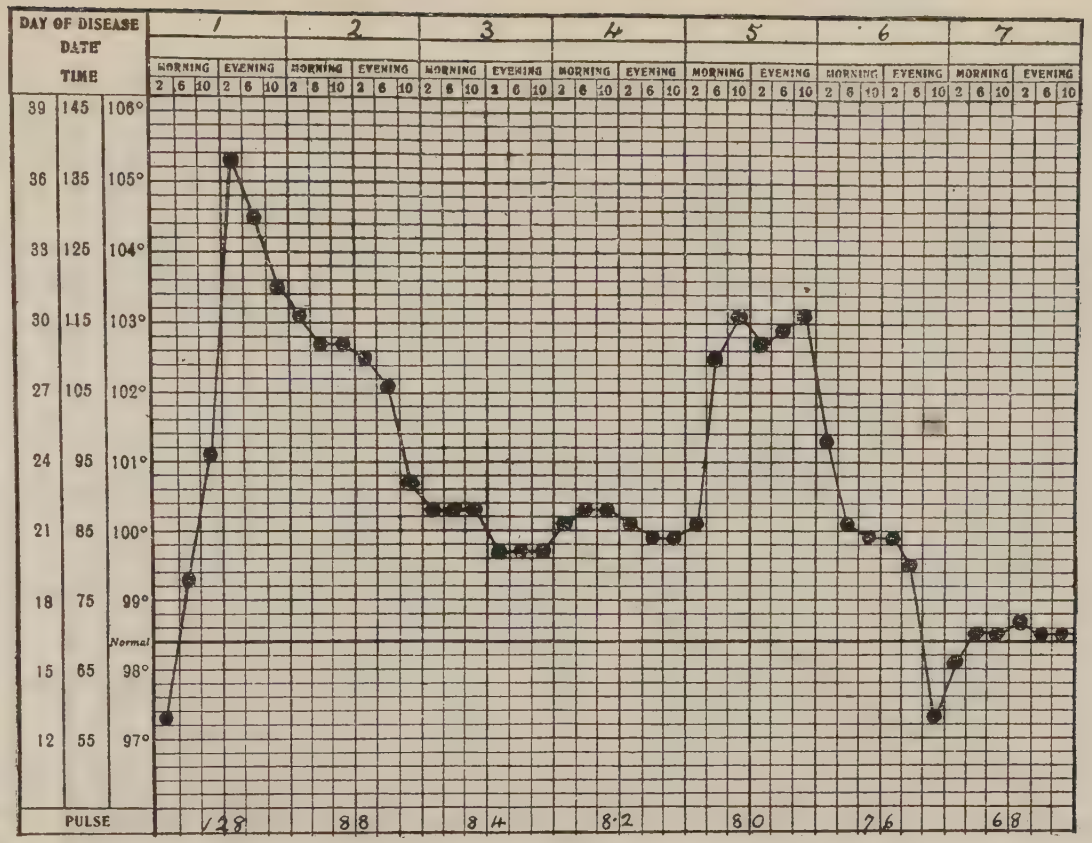


Temperature in mild case of Dengue.

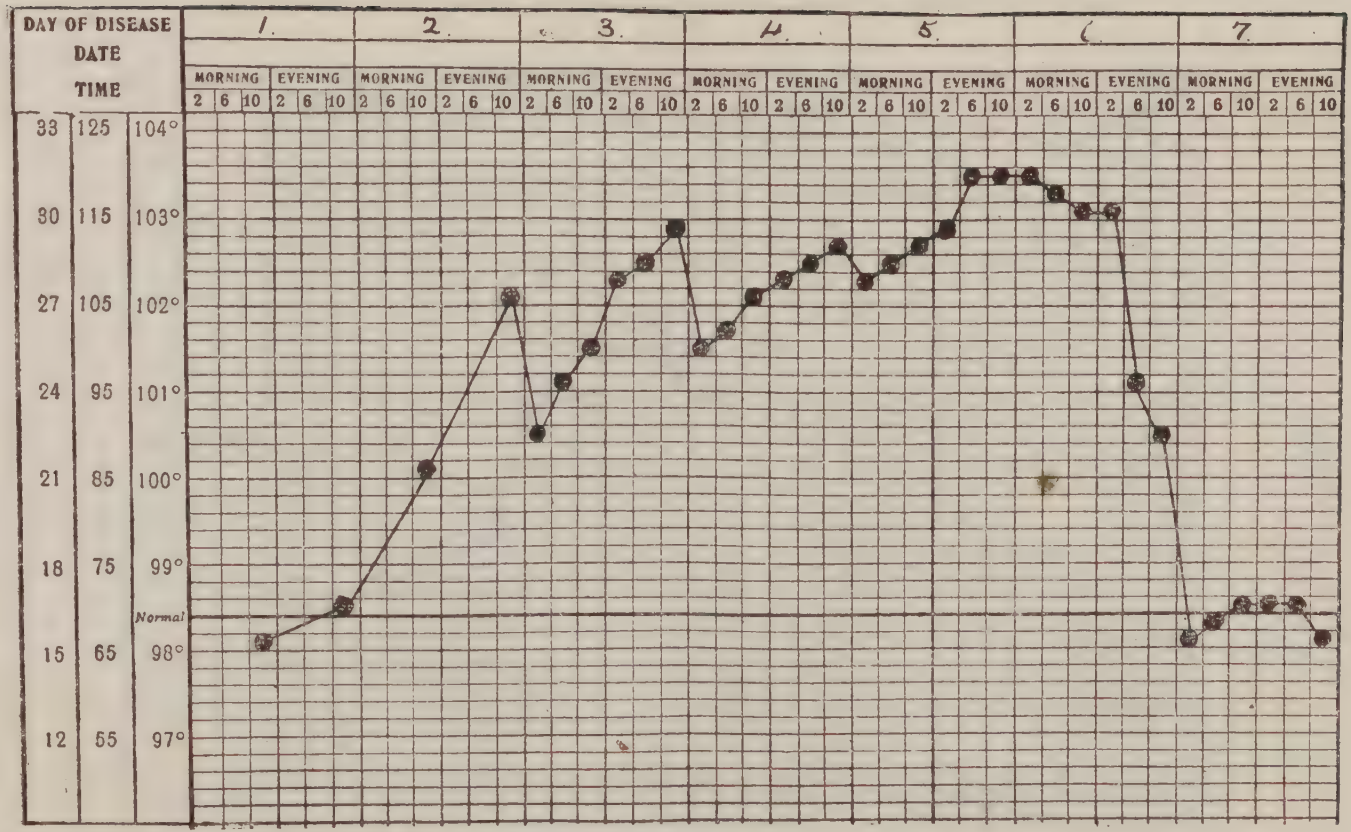
II.



Typical Dengue.



Saddle-back temperature in case of seven-day fever—atypical Dengue.



Atypical Dengue simulating early typhoid or paratyphoid.

IV.

Fig. 2.

Culex fatigans ♀.

(*After Patton & Cragg.*)

To face p. 24.]

DIARRHŒA.

Although a good deal of the diarrhœa seen on the Gallipoli Peninsula and at Mudros was merely a prelude to attacks of true dysentery, there were undoubtedly many cases of acute diarrhœa unassociated with any form of dysentery or with flagellate infection.

It seems probable that the chief causes of this acute non-specific diarrhœa were the ingestion of large quantities of irritating dust, the partaking of a somewhat coarse and monotonous dietary, and exposure to chill. The neurasthenic state may also render men prone to looseness of the bowels. The water supply does not appear to have been to blame to any great extent. Flies, by fouling food and thereby tainting it, have doubtless played a part.

Treatment.—In any case of acute diarrhœa it is probably inadvisable immediately to administer astringents, and this is a matter of still greater importance when there is a risk of a diarrhœic attack passing into dysentery or cholera.

A diarrhœa will often cure itself in time, but it may last for days and leave a subacute irritation of the bowel behind it. The object of the initial treatment must therefore be to prevent irritation and the absorption of toxins by favouring and not by preventing free catharsis.

For this purpose, unless the patient is already faint and weak, give one ounce of castor oil. To facilitate its administration and prevent its rejection the following method may be tried :—Place an ounce of brandy in a glass or cup. Carefully pour the oil into the centre of the brandy and then add one ounce of water. The mass of oil will then resemble the yolk of a raw egg enclosed in the white. Lime juice may be used instead of brandy. Failing these, black coffee helps to cover the taste and "feel" of the oil. If oil is not available, 3 grains of calomel with 15 grains of sodium bicarbonate may be substituted, or half an ounce of magnesium sulphate.

Whatever evacuant is used, starve the patient thereafter for from 12 to 24 hours, but let him have plenty of hot water or hot tea to drink. Cool water may be given if desired. Complete rest is essential. Several hours after the purgative has been taken, if one is satisfied that the case is not going to prove one of dysentery, commence to give carbonate of bismuth 15 grains and salol 5 grains combined in one powder, this dose being repeated every two hours for ten doses. If desired, larger doses may be given over a shorter period. For distension and colic nothing is better than two teaspoonfuls of paregoric (Tinct. camp. co.) in hot water. Repeat every two hours for two or three doses.

A small dose of morphia, say one-tenth grain of morphine sulphate by the mouth, repeated in three hours if needed, will

check any tendency to excessive catharsis. For very severe griping a moderate dose of morphia and atropine hypodermically may be necessary, but is better avoided. Apply heat to the abdomen and give hot drinks. If opium is used a laxative may be needed later, as irritating matter may remain in the bowels. If there is faintness, strychnine, brandy and sal volatile are indicated. A hot bath, when it can be managed, sometimes acts like a charm, and in cases where the diarrhœa is due to chill and exposure even the immersion of the feet and legs in hot water and mustard does good.

After 12 or 24 hours give hot milk, Benger's food, gruel of any kind, and gradually work up to a normal dietary. If considered advisable the bismuth subcarbonate in a dose of 15 grains may be continued thrice daily for a few days, but it is not advisable to carry on this treatment too long, as bismuth tends to accumulate in the intestinal tract.

An iron or other tonic is often useful after a bad attack of diarrhœa, and the abdomen should be well protected from chill, especially at night. While the above method is often very effective, some prefer to continue the castor oil throughout the period of starvation in one-dram doses made up as an emulsion and given four- or six-hourly. Sometimes this will of itself effectually cure the condition, but usually only in cases seen early and before there has been much pain or exhaustion.

The bismuth treatment can, as a rule, only be effectively carried out when the patient can be kept under observation and receive proper attention. Under conditions which render this impossible he may often be successfully treated after the preliminary purgation by four-hourly doses of the following mixture :—

℞

Tinct. opii.	♏ 10
Spir. ammon. arom.	♏ 30
Ess. menth. pip.	♏ 20
Tinct. catechu.	℥ i
Aquæ ad	℥ i

There is a form of acute diarrhœa, the result of excessive purgation, which may be very alarming, especially in enfeebled subjects. When feasible a hot bath is indicated for this class of case, together with absolute rest, stimulants, and the administration of such a mixture as the following :—

℞

Acid sulph. aromat.	℥ ss
Ol. cajaput.	♏ 40
Ext. hæmatox.	℥ ii
Spir. chloroformi.	℥ i
Syrup. zingiber.	℥ iii

Sig. A teaspoonful in water every two or three hours.

DYSENTERY.

Although happily the mortality caused by it has not been great, dysentery has been very prevalent amongst the troops serving in the eastern Mediterranean area. Its occurrence has undoubtedly been favoured by the presence of dust storms, for the ingestion of irritating dust particles causes a condition in the mucous membrane of the bowel suitable for invasion by intestinal organisms. There has been considerable discussion as to which of the two chief types has been most in evidence, but it suffices here to say that both amœbic and bacillary dysentery have taken toll of the forces. It is probable that throughout the winter season bacillary dysentery will be the more frequent and a recrudescence of the amœbic form may be expected with the advent of warm weather. Mixed infections have undoubtedly been common. Dysentery in epidemic form may be due to *Entamœba histolytica* (amœbic dysentery), or possibly to other protozoal organisms such as the flagellates, including *Trichomonas hominis*, *Tetramitus mesnili*, *Lamblia intestinalis* (flagellate diarrhœa), or to *Balantidium coli* (ciliate dysentery). Recently a coccidium has been found in the stools of men invalided from Gallipoli, and as this organism in its development injures and destroys the intestinal epithelium, it is conceivable that it may occasionally produce dysenteric symptoms. Epidemic bacillary dysentery is caused by one or more of the bacilli constituting the dysentery group, but for all practical purposes the bacillus of Shiga and those of the Flexner type are all that need be taken into account.

AMŒBIC DYSENTERY.

The cause is *Entamœba histolytica*. *E. coli* so frequently found in the stools is non-pathogenic. The differences existing between both the vegetative and cystic forms of these two organisms are shown in the accompanying illustration (fig. 3). The important point for the clinician and sanitarian to remember is that the vegetative forms of the dysentery amœba, *i.e.*, those which throw out pseudopodia, absorb nourishment and manufacture toxins, are not resistant outside the body. They easily perish, but this is not true of the cysts, which, so long as they are in contact with a little moisture, remain alive, and if swallowed are capable of causing infection. These cysts are chiefly found in the solid or semi-solid fæces of the convalescent, and hence the post-dysenteric is the cyst carrier and the principal danger in camp life. Apart from the carrier, infection may take place through the medium of water, flies, wind, soiled toilet paper blown from open latrines and possibly also from dust, provided

the cysts have not had time to dry and perish. When the cysts are swallowed their envelopes are dissolved by the digestive juices and their contents divide to produce small amœbæ which, like their ancestor, are pathogenic.

Symptoms.

Two chief types of amœbic dysentery may be distinguished, one with an insidious onset commencing with diarrhœa and without much general disturbance, the other more acute with severe griping. In the former three or four pultaceous stools may at first be passed in the day, and there is often tenderness over the cæcum and along the line of the large intestine.

Fever is absent and the patient presents little signs of illness beyond vague intestinal discomfort, a progressive weakness, the passage of frequent stools and a steady loss of weight. The skin gets dry and sallow and neurasthenic symptoms appear. The stools vary. They may remain merely pultaceous or become gradually mucoid and show streaks of blood. Mucus alone may be present. Very often this chronic course is punctuated by exacerbations, when there is abdominal pain and some tenesmus. Gangrene may supervene and sloughs be passed.

This chronic type has not been so common at Mudros and the Dardanelles as the acute form, which, after premonitory diarrhœa, starts with griping pain, often severe, and the frequent passage of motions containing blood and mucus, such passage being associated with much straining and tenesmus. As a rule there is no fever but nausea and vomiting often occur, the tongue is moist and coated and there is anorexia. The disease tends to recovery, save in the somewhat rare forms with fever and toxæmia, but may pass into a chronic type while hæmorrhage or gangrenous complications may supervene.

A latent form of amœbic dysentery requires special mention for it is apt to escape notice and is probably a fruitful source of "carriers." Further, this class of case when untreated may develop acute attacks or liver abscess. Sometimes a history of occasional diarrhœa, sometimes symptoms suggesting appendicitis, sometimes complaints of indigestion arouse suspicion. Then, where possible, a saline should be given and the stools examined for amœbæ.

Morbid Anatomy.

The ulcerative process, brought about chiefly by the amœbæ burrowing down to the submucosa and elaborating their toxins, is confined to the large intestine; the cæcum, hepatic flexure and sigmoid being most frequently affected. The appendix may be involved. The condition found postmortem varies from nodules of infiltration surrounded by a red ring of dilated vessels to large circular or oval ulcers with undermined edges, the latter having the longer diameter lying as a rule transversely to the long diameter of the bowel. Stretches of healthy mucous membrane intervene

It has now been definitely shown that house-flies and some other allied species of flies take up living cysts from infected stools, transmit them to food or drink. The cysts pass through the fly & are voided, still living, in its excreta. There is no evidence that they ensue in the fly's vomit or that they survive on the exterior of the fly. From these observations it seems probable that the fly is, if not the chief, at least one of the most important means whereby the virus of amoebic dysentery is disseminated. Recently the rat has been found to suffer from an amoebic dysentery caused by an organism indistinguishable from the human E. histolytica. It has been advanced that this rodent may play a part in disseminating dysentery & other pathogenic to man./

(The mucus of the bacillary dysentery stool practically wholly consists of an exudate ~~consisting~~ made up of entirely of pus, intestinal epithelial cells + large macrophages. This is not a feature of the mucus of the amoebic stool.)

(together with some additions + changes the result of further experience.)

between the affected areas. In advanced cases thrombosis of vessels occurs, the ulcers may be covered with necrotic sloughs and the bowel wall at these points considerably thinned. These few notes will serve to illustrate points in the pathogenicity and treatment of the disease.

Differential Diagnosis.

From bacillary dysentery by microscopic examination of the stools and bacteriological tests. Clinically the diseases can rarely be differentiated, though a severe onset and rise of temperature suggest the bacillary form. The idea that a diagnosis can easily be made from the mere appearance of the stools is entirely fallacious, but it is true that the large number of pus cells in the mucoid stool of bacillary dysentery tends to give it a whitish appearance while in amœbic cases the colour is brown or greyish green It must be remembered that the excretion of *E. histolytica* is frequently intermittent, hence several examinations of the fæces at appropriate intervals are often necessary.

It is also worth remembering that there is a bilharzial dysentery, a dysentery due to bacteria other than those of the dysentery group, *i.e.*, *B. pyocyaneus*, etc., and that dysenteric symptoms may be caused by mechanical irritants.

Complications.

Hepatitis, liver abscess, intestinal gangrene, and peritonitis may be mentioned. The attack may be followed by chronic constipation accompanying a condition known as " dry recto-colitis," in which emetine has been found beneficial.

Prognosis.

Thanks to emetine this is now excellent. Untreated or wrongly treated cases may go from bad to worse, become chronic or lead to liver abscess. The importance of early, correct and efficient treatment cannot be overrated. Carefully wash the stools and examine for sloughs from time to time, as their presence or absence shows how the case is progressing.

Treatment.

This is fully detailed in the special memorandum circulated to Medical Officers with the M.E.F., but a short *résumé* is given here.

Dietetic.

No milk at first. Give albumin water, rice-water, chicken broth, etc., for the first 24 hours. Thereafter milk diluted with barley water or with citrate of soda added (3 grains to the ~~pint~~) to prevent curd formation. Soups are often useful. Later custard, arrowroot, jellies, etc.

Give food in small quantities frequently and see that it is neither too hot nor too cold. Alcohol is deleterious.

Medicinal.

Begin with an ounce of castor oil. If colic is present add 10 drops of Tinct. opii to the dose. This with rest, warmth and proper diet will often check a diarrhœa which, if not thus treated, might pass on into a true dysentery.

Emetine is a specific. Administer it from the very diarrhœic stage in doses of ½ of a grain once or twice a day, given by the needle intramuscularly or intracellularly. Continue it in doses of one grain daily until blood disappears and yellow bile-stained material reappears in the stools. At the same time, save in mild and trivial cases give a saline mixture once a day, for example,

Sod. (or magnes.) sulphat.	...	...	gr. 60
Acid sulph. dil.	...	...	m. 15
Tinct. zingiber	...	...	m. 5
Aq. menth. pip.	...	...	½ oz.

This prevents constipation, washes away cysts, diminishes the risk from toxins and of septic absorption, and possibly aids the emetine to get at certain of the entamœbæ lying at the base of or amongst necrosed tissue. It also benefits the colitis, and the same end may be served by the administration of enemata of warm water or saline. A hot hip bath affords relief while a soothing injection is made by soaking an ounce of linseed for several hours in 2 pints of warm water. Later on, when the stool is free from blood but still contains mucus, astringent enemata of tannin may be substituted or "eusol" injections may be tried. A suppository of cocaine and morphia aids the administration. Be careful to sterilize the nozzle of the injection tube after use. As soon as the blood has vanished from the stools and there is evidence of bile, cut down the dose of emetine to half a grain daily and do not continue using this very costly drug in a reckless and useless manner. Give it for a week or ten days, then wait for a week and start a second course if necessary, or give the daily dose for a week and throughout a second week inject the emetine on alternate days. Save in cases of persistent cyst infection it is rarely if ever necessary to embark, as has far too often been done, on repeated courses of emetine. Remember that if emetine is going to do good its beneficial action is speedily apparent. In any severe and gangrenous cases emetine may be given intravenously in a dose of 1½ grains dissolved in 10 c.c. of saline.

During convalescence if diarrhœa persists salicylate of bismuth is very useful. In some cases bismuth in large doses throughout the attack is found to do good.

Failing emetine, ipecacuanha must be given according to the usual formula (See Memorandum).

In all cases the tendency to heart failure must be guarded against. Hypodermics of camphor are indicated (2 grains in 10 minims of olive oil or in vaporole form).

Avoid opium unless the colic is severe or the tenesmus distressing. In the latter case employ it with bismuth and thin starch as

of the hydrobromide

1½ grains daily for 12 days, giving one grain by the mouth each morning & half a grain by the mouth every evening, the latter dose preferably in keratin-coated tablets. The oral exhibition may occasionally cause vomiting but this is not a contra-indication. The symptoms usually disappear before the course is completed but the bowels should not be allowed to become relaxed.

One ounce of sodium or magnesium sulphate.

Remember further that it is a very costly drug and should not be used in a wasteful manner.

A new double iodide of antimony & bismuth in daily doses of 3 grains by the mouth continued for 12 successive days promises well, especially as regards the eradication of cysts. In the case of carriers it seems best to give the drug during or just after a full meal.

^ The introduction of the above-mentioned enetic-
-bacterium-bolide is likely to lead to the
abandonment of this method.

an enema, bismuth 2 drams, tincture of opium 30 minims and starch 2 ounces.

As regards complications liver abscess should not occur in properly treated cases, but if it shows signs of developing emetine will often cut it short and cause a cure.

Turpentine stupes to the abdomen are useful in severe colic. Hæmorrhage is to be met by morphia, adrenalin, turpentine or chloride of calcium.

The tendency to collapse induced by the draining of the patient and the action of toxins is best met by giving intravenous saline infusions as in cholera (see instructions in cholera equipment), but these must be administered in time. It is no use waiting till the patient develops a Hippocratic countenance. A timely infusion may ward off this sign of impending death. The production of local anæsthesia by the previous injection of 1 or 2 minims of a 2 per cent. cocaine solution with a fine needle alongside the vein facilitates transfusion.

Chronic cases require large enemata of copper sulphate 1 in 1,000, or nitrate of silver or "eusol" with starch and opium.

General and Prophylactic.

The necessity for rest and warmth to the abdomen, as by a light linseed or oatmeal poultice sprinkled with laudanum, need scarcely be insisted upon. A tight flannel binder sometimes eases the pain of straining.

Careful disinfection of the stools is essential and the danger of the cyst-carrying convalescent kept well in mind. It is of special importance to see that company cooks are not suffering from diarrhœa or dysenteric symptoms.

No post-dysenteric should return to duty until at least three weeks have elapsed since discharge from hospital. The sanitary arrangements for post-dysenterics require special care. They must thoroughly wash and scrub their hands after going to stool, and every effort must be made, as by the provision of fly-proof and wind-proof box latrines, etc., to prevent them infecting others (see section on Camp Sanitation). A French method of treating possible carriers which might be tried in the case of men getting ready to leave hospital and in convalescent and rest camps is to give 8 or 10 drops of an emetine mixture every night in a cup of strong tea. The mixture is made by dissolving 4 or 5 grains of the hydrochloride in tincture of opium in the strength of 1 in 15.

Water supplies must be properly chlorinated, and all the usual rules of camp hygiene rigidly enforced (see sections on Insect Pests and Camp Sanitation).

BACILLARY DYSENTERY.

The cause has already been mentioned—Shiga infections being the more common. Recently *B. dysenteriæ* has been found in the peripheral blood.

Like typhoid, the spread of bacillary dysentery may be said to be

due to carriers, contact cases, drinking water, the dust of dried dejecta and the repulsive regurgitation, dangerous droppings and filthy feet of faecal-feeding flies. In this connection it may be noted that dysentery bacilli have been recovered from flies two or three days after their absorption by these insects.

Symptoms.

The incubation period would appear to vary from 24 hours to 7 days. The onset, which may follow a premonitory diarrhœa or constipation, is sudden and attended by pain and an urgent call to stool. At first the motions are normal but as the attack advances the colic grows more severe, straining and tenesmus set in, there is diarrhoea and soon the fæculent matter is mixed with blood and mucus while later the blood and mucus predominate and finally constitute the whole motion. There is great discomfort about the anus, which becomes inflamed, excoriated and very painful, and the bowel may prolapse. Vesical tenesmus may occur and the urine is diminished in quantity. The tongue is moist and coated with a white fur, nausea is frequent, vomiting comparatively rare. The temperature usually rises somewhat and may be considerably elevated, a contrast to what occurs in the amœbic form. The number of stools is generally from 15 to 30 in the 24 hours but it may become excessive and exceedingly exhausting to the patient. The thickened bowel may be capable of palpation if the abdomen is not too tender. As already stated, the stools, being markedly muco-purulent, are often white like milk but they are rarely free from blood, which usually occurs as flecks or streaks.

When the small intestine becomes involved, for this sometimes occurs and is very dangerous, the temperature remains elevated and general symptoms are much more severe though the tenesmus is less and the stools fewer. It is well to remember that the small intestine, if not involved, may be full of fæces, *i.e.*, there may be a constipation accompanying the diarrhœa and causing distension.

There is a serious type of case where the muco-purulent stool becomes serous and the patient rapidly wastes. It is this type which is specially prone to choleraic-like collapse. In any of the forms gangrene may ensue and offensive sloughs be passed. Toxæmia is then usually very marked, the tongue becoming dry and glazed, the pulse thready and a low muttering delirium supervening. Hiccough may set in and prove exhausting.

It will be seen that bacillary dysentery tends to be more acute and more toxæmic than the amœbic type.

A chronic form, however, is also known, that is to say a form more or less chronic from the outset, characterised by frequent stools containing blood and mucus, digestive troubles and progressive weakness, anæmia and neurasthenia.

Morbid Anatomy.

In the earlier stages the appearance of the mucous membrane of the large intestine has been aptly compared to lustreless red velvet.

In ordinary ulcerative cases the purpura depends on the quality rather than on the quantity of the stool. The patient is often heavy & drowsy & exhibits rather a characteristic blush-red flush on the cheeks. This

A recent account of cases seen in Egypt classes them as 1. Mild (patient apparently well but passing a little blood & mucus). 2. Catarrhal. 3. Ordinary ulcerative. 4. Fulminating. 5. Cholerais (Fiedler.) In toxaemic cases the diarrhoea is of secondary importance to the toxaemia.

a further 30 c.c. may be given on the following day.

is done similar to the above.

Intravenous administration is also indicated where there is much tenacious mucus + dark decomposed blood present in bronchi, together with much dark bile, and especially if the serum is bile-stained & has a heavy, foul odour.

following

Sod. (or magnes.) sulphat	gr. 60
Acid. sulph. dil.	M. 15
Tinct. zingiber.	M. 5
Aq. menth. pip.	½ oz.

In order to guard against anaphylaxis some give 5 c.c. of the serum subcutaneously directly on admission. As much as 40 c.c. of the serum has been given in bad cases + it has apparently been the means of saving the patient.

This is due to the acute inflammation which frequently involves the lower third of the ileum, although Peyer's patches remain unaffected. Later there are areas of blood extravasation beneath the surface and irregular islands of greyish membrane surrounded by hyperæmic and swollen gut. The condition is one of diffuse superficial coagulation necrosis and the small ulcers are not deep as in the amœbic form.

Differential Diagnosis.

That from amœbic dysentery has been mentioned. Bilharzial dysentery must be borne in mind, and in the more chronic cases the possibility of tubercle, cancer and syphilis must be excluded.

Complications.

Intestinal gangrene, peritonitis, eye affections, rheumatic symptoms and polyneuritis may be mentioned. The last named, which may be associated with œdema, tends to pass off as the ulcerations heal up. Small, multiple and confluent liver abscesses may occur. An acute suprarenal syndrome has been described.

Prognosis.

In untreated cases it may be said that the immediate prognosis is probably worse than in untreated cases of amœbic dysentery, and the late prognosis better as there is no risk of liver abscess.

If promptly and properly treated bacillary dysentery quickly clears up. If neglected or wrongly treated there is often no more distressing and rapidly fatal complaint.

Treatment.

Diet, general measures and early medicinal treatment as for amœbic dysentery. The specific for bacillary dysentery is polyvalent anti-dysenteric serum. It should be given as early as possible, the usual dose being 20 c.c. subcutaneously. If necessary as much as 60 c.c. may be injected or the above dose may be repeated. In bad cases of so-called entero-dysentery in which the small intestine is involved it may be advisable to give the serum intravenously. Its action is often remarkable.

In addition, or if the serum is not available, the saline mixture mentioned under amœbic dysentery is to be used, given every four or six hours at first, or even more frequently, and then increasing the intervals between doses until the stools are watery and bile-stained. In Central Europe the bolus alba (kaolin) and animal charcoal treatment in daily doses of 3–4 tablespoonfuls of each suspended in water has come largely into use.

Simple lavage of the lower bowel is very comforting.

It is in bacillary dysentery, more especially in those cases where the stools become serous, that intravenous saline infusion as for cholera, and begun sufficiently early, is likely to be very efficacious. An emergency injection fluid consists of common salt 60 grains,

carbonate of soda 60 grains, boiled water 1 quart. Give one to three quarts at a temperature of 100° F., carefully watching the effect. *See* Section on Cholera.

In cases with persistent hiccough, where ordinary measures fail, blister the line of the vagus on each side of the neck.

Adrenalin, both by the mouth and as an enema, is said to have a remarkable sedative effect on the abdominal pains and tenesmus.

Treat chronic cases as in the amœbic type, or preferably where possible use enemata of the organic silver compounds albargin (silver gelatose) 1 in 500, or protargol 1 in 100, or "eusol" in half the strength used for septic wounds. Enemata of olive oil sometimes prove very useful. Sensitized vaccines are coming into use.

The prophylaxis is in the main the same as that for amœbic dysentery. Carriers exist as in typhoid and are troublesome.

NOTE.—In cases of doubtful etiology, and there are many such on the Peninsula, there should be no hesitation in employing a combined therapy of emetine and polyvalent serum.

FLAGELLATE DYSENTERY OR [illegible] DIARRHŒA.

The causative organisms have already been mentioned. Their rôle is somewhat doubtful, but there would certainly seem to be a form of persistent watery diarrhœa with bright yellow stools associated with the presence of *Trichomonas intestinalis*. This infection may be treated by enemata of iodine 1 in 1,000, giving $1\frac{3}{4}$ pints (1 litre) every evening for three consecutive days and preceding the iodine enema by one of boiled water.

Chronic trichomoniasis may be treated by turpentine. For all forms of flagellate dysentery methylene blue may be tried in 2 to 3 grain doses in cachet and for intestinal injection in a strength of 1 in 5,000 or 1 in 3,000. The stools and urine become blue under this treatment.

CILIATE DYSENTERY

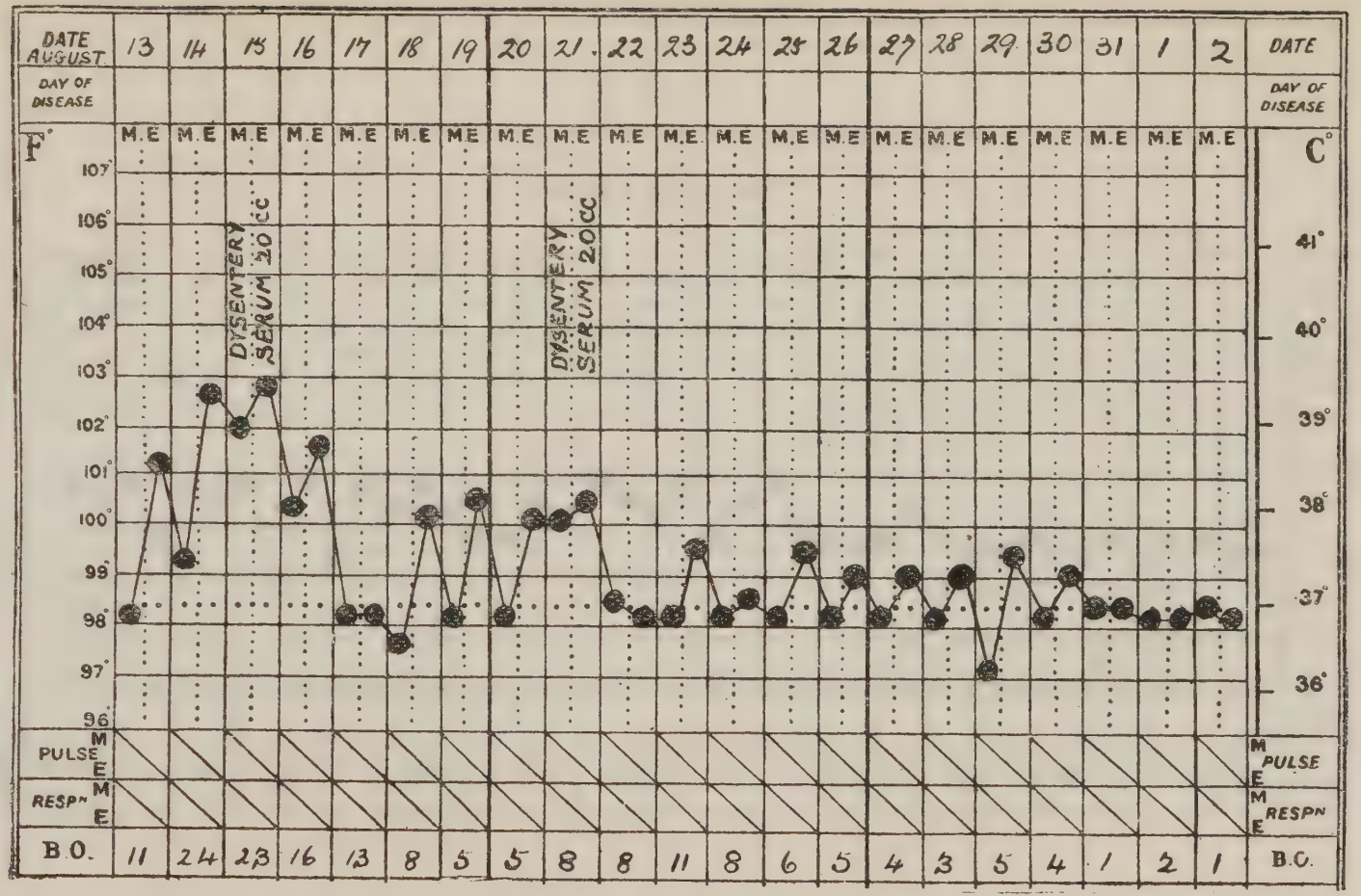
This is so rare that it requires no further consideration here.

The diet generally requires special care. The fluids
advance in this [illegible] have already been noted
10 days [illegible] during which time none but
more than 2 ounces in the 24 hours (1 litre). The
second week [illegible] may be given. After [illegible] should add
-ition.

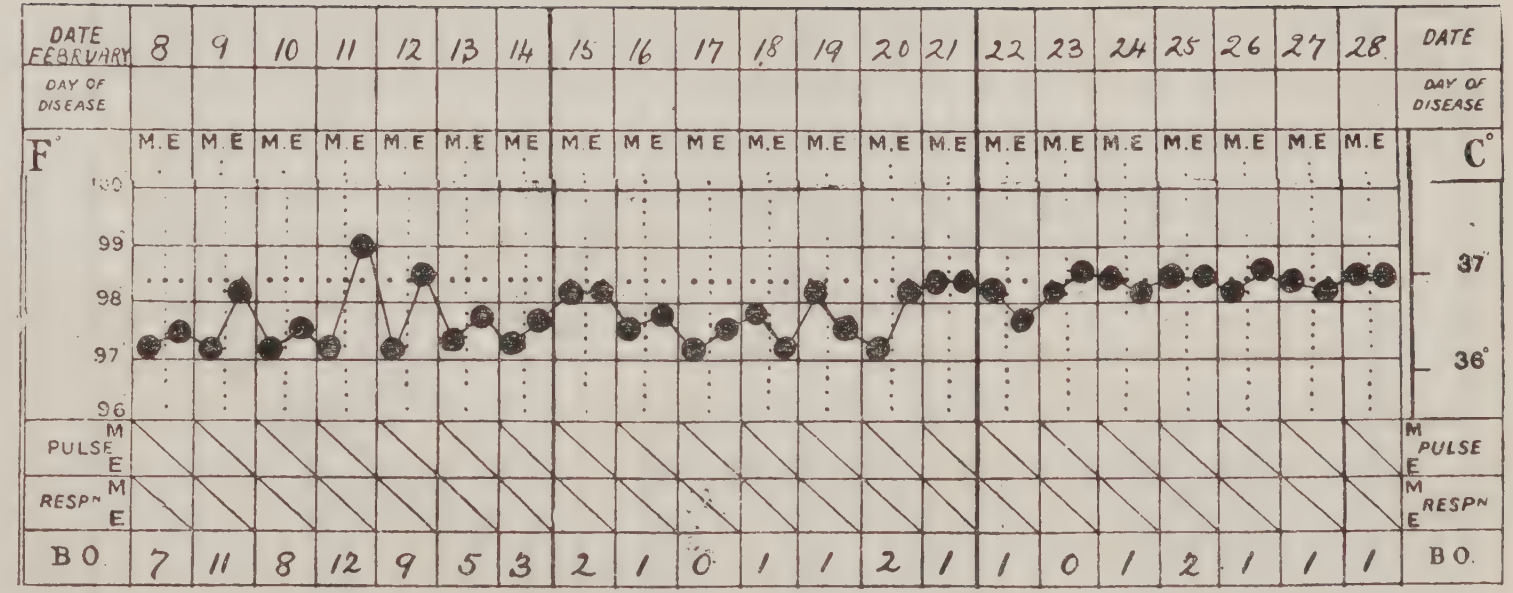
In subacute chronic cases which have become
marasmic the administration of solutions of glucose
will often be found beneficial. They may be given
intramuscularly or intravenously up to 1000 c.c.

A useful drug in all flagellate diarrhoeas is bis-
-muth salicylate given steadily in doses of 20 grains
three daily.

There seems little doubt that Lamblia, whose habitat
is in the small intestine, does induce diarrhoea
& some evidence is forthcoming to show that rats
& mice may serve as vectors of this parasite to
[illegible] man.

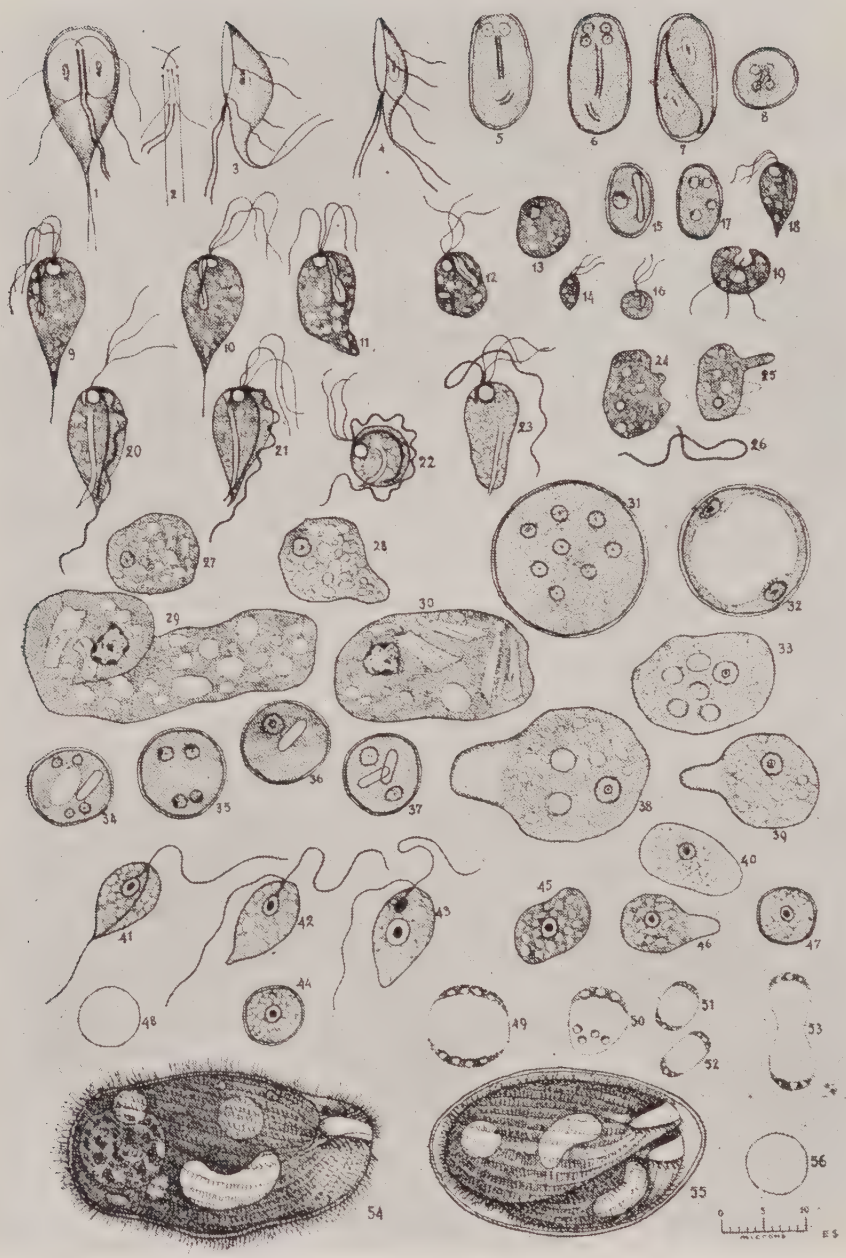


BACILLARY DYSENTERY.



AMŒBIC DYSENTERY.

Fig. 3.



THE COMMON INTESTINAL PROTOZOA OF MAN. (AFTER WENYON.)

To face p. 37.]

Description of Plate.

All the figures have been drawn to one scale (shown at bottom of Plate) with the exception of Figs. 54 and 55, which are only half the size they should be. An ordinary human red blood corpuscle on same scale is shown at Figs. 48 and 56 for comparison.

Lamblia Intestinalis (Figs. 1–8).

1. Surface view showing sucking disc, two nuclei, and eight flagella.
2. Origin of flagella as seen in stained preparations. They are represented as being more spread out than is actually the case.
3. Side view of thick form.
4. Side view of narrow form.
5. Encysted form with two nuclei.
6. Encysted form with four nuclei.
7. Encysted form containing two flagellates
8. Appearance of cyst when viewed on end. The cysts are sometimes shorter in proportion to their breadth and much more definitely egg-shaped, with one end slightly narrower than the other, than represented in the plate.

Tetramitus Mesnili (Figs. 9–19).

9. Form with overlapping lips of cytostome.
10. Form showing flagellum in cytostome.
11. Form in which posterior filamentous extremity is retracted.
12. Still further retracted form.
13. Rounded form in which flagella are lost so that the resemblance to a small amœba is marked.
14. Very small form of normal shape.
15. Encysted form with single nucleus and cytostome visible.
16. Very small round form.
17. Possibly encysted form with four nuclei.
18. Intermediate form of normal shape.
19. Appearance of flagellate when viewed on end, the cytostome with the incurved lips shown clearly, as also the flagellum within.

Trichomonas Intestinalis (Figs. 20-26).

20. Flagellate of normal structure; the three flagella appear to have a common base, possibly due to their being twisted round one another.
21. Flagellate of normal structure; the three flagella are free in their entire length.
22. Rounding off form with undulating membrane running round margin.
23. Degenerating form; the large flagellum has broken loose from the undulating membrane, so that the flagellate has the appearance of having one large and three smaller flagella.
24. Further degeneration; the flagella and axostyle are lost, so that the appearance is of an amœba with undulating border.
25. Amœboid form throwing out the finger-like pseudopodium, which rapidly passes down side of body into dotted positions, where it disappears.
26. Detached flagellum.

Entamœba Coli (Figs. 27-32).

27. Small entamœba of roughly spherical form and vacuolated cytostome.
28. Small entamœba forming pseudopodium with no distinction between ecto- and endo-plasm.
29. Large entamœba of irregular shape.

30. Large entamœba with slit-like rectangular vacuoles.
31. Encysted form as it appears in the fæces. This is the form most commonly observed and which is most useful for diagnostic purposes.
32. Encysted form of abnormal type with large central vacuole. In other cases there may be several vacuoles, and the vacuolation has the effect of retarding nuclear division, as such forms usually have only two, or possibly four, nuclei.

In *E. coli* infections it is generally only the completely developed cyst with eight nuclei which is passed in fæces. The earlier stages of development with one, two, and four nuclei take place in the large intestine before the cysts escape.

Entamœba Histolytica (Figs. 33-40).

33. Large tissue-invading form ("tetragena" form) containing five red blood corpuscles.
34. Encysted form with four nuclei, chromidial body, and vacuole.
35. Encysted form with four nuclei. It is distinguished by its smaller size from the four-nuclear stage of *E. coli*, which, however, is rarely passed in the fæces.
36. Encysted form with one nucleus and chromidial body.
37. Encysted form with two nuclei and two chromidial bodies.
38. Large tissue-invading form with ectoplasmic pseudopodium and containing two red blood corpuscles.
39. Small form of intermediate size with ectoplasmic pseudopodium.
40. Small "minuta" form as seen in post-dysenteric conditions.

The encysted forms begin to appear as the acute dysenteric symptoms subside, and are thus very characteristic of the infection in carrier cases. It is important to note that they are much smaller than the cysts of *E. coli*. In *E. histolytica* infections it is usual to find passed in the fæces cysts in all stages of development.

Cercomonas, *Bodo*, *Prowazekia* (Figs. 41-44).

41. Cercomonas. The backwardly directed flagellum is adherent to the body. There is only a single nucleus.
42. Bodo. The two flagella are free and there is only a single nucleus.
43. Prowazekia. The two flagella are free and there are two nuclei.
44. Encysted form of any of above three flagellates.

Amœba Limax (Figs. 45-47).

45. Form without pseudopodium and characteristic "limax" nucleus.
46. Form with pseudopodium.
47. Encysted form.
48. Red blood corpuscle to show relative size of objects in plate.

Blastocystis Hominis (Figs. 49-53).

49. Large spherical form with several nuclei in semilunar protoplasm at opposite poles.
50. Somewhat triangular form with many nuclei.
51. Small oval form.
52. Small elongated form.
53. Elongated dividing form.

This organism is of a vegetable nature, but under certain conditions degenerating flagellates and small amœbæ or the encysted forms of these, by the development of a large central vacuole, will closely simulate the true Blastocystis.

Balantidium Coli (Figs. 54-55).

54. Free ciliate as it lives in lumen of gut and in tissues.
55. Encysted form containing two ciliates as passed in fæces.
56. Red blood corpuscle as in Fig. 48.

To face p. 38.]

Fig. 4.

The extracorporeal development of the human coccidium (Isospora) as it occurs after being passed in the fæces. On the ground or in water the oöcyst becomes infective by development as shown in figs. 1–4, producing finally within it 2 sporocysts each containing 4 sporozoites and a residual mass of cytoplasm. There occurs more rarely in Gallipoli cases another coccidium (Eimeria) which has a spherical oöcyst, 20 microns in diameter and produces 4 sporocysts each with 2 sporozoites. (After Wenyon.)

HEAT-STROKE.

Etiology.—It would appear to be due to an autointoxication caused by the non-radiation of heat from the body owing to insufficient evaporation from the skin. As a result toxic substances accumulate which have a selective action on the nerve cells. Some, however, believe the condition to be a tissue acidosis, there being a retention of carbonic and lactic acid and a consequent depleting of the blood of its alkali content.

In any case there can be no doubt that high relative humidity of the air is a very potent factor in producing attacks of heat stroke and heat prostration as it notably checks cutaneous evaporation. Alcoholism is one of the chief predisposing causes.

The milder forms are known as Heat-Exhaustion and Heat-Prostration.

Heat-Exhaustion will often overtake heavily laden soldiers on the march in hot weather, and as soon as the man is relieved of his accoutrement and has a rest he rapidly recovers. The condition is really a syncope and a milder form of

Heat-Prostration, in which there is giddiness and frequently nausea, the patient becoming bathed in a clammy sweat and exhibiting dilated pupils. The pulse is thready, the breathing shallow, and it may be sighing and unconsciousness may follow. The condition is non-febrile and indeed a subnormal temperature may be registered. After recovery headache may be troublesome and mental confusion and other cerebral symptoms may be noticed. Rarely the fainting fit ends in death.

Heat Stroke proper is a much more serious matter, and two clinical types may be differentiated: 1, Thermic Fever; 2, Heat-Cramp. An early warning sign in heat-stroke is a desire for frequent micturition and other prodromata are drowsiness, vertigo, headache and intolerance of light. The pulse is quick, rapidly becoming irregular, the skin is hot and dry and the temperature elevated. Delirium, coma or convulsions may ensue. The attack may come on very suddenly. Three main types have been observed amongst German troops:—

(*a*) *Asphyxial*, where the soldier, fighting against an overpowering feeling of prostration, continues to march with tottering gait, fixed stare, contracted pupils and cyanosed face until he collapses senseless and apparently dead. His breathing is in abeyance, his pulse imperceptible at the wrist and his face deeply cyanosed.

(*b*) *Paralytic*, in which there is deep coma, recurring convulsions, vomiting, diarrhœa and hyperpyrexia. The skin and dejecta may emit a mousy odour.

(*c*) *Psychopathic*, which is not so deadly and in which the patient's mental balance is upset. His mind may be merely confused or he may pass into a muttering delirium or become violent and excited, or harbour delusions which may drive him to suicide.

Heat-Cramp is chiefly seen amongst ships' firemen in the tropics and need not be further considered here.

Differential Diagnosis.—True heat-stroke must not be mistaken for an attack of cerebral malaria, though it is often very difficult to distinguish them. The blood should be examined for parasites, the splenic region palpated and percussed and the history, if possible, obtained.

Cerebral hæmorrhage in which the rise of temperature *follows* the insensibility, and cerebro-spinal fever have been mistaken for heat stroke.

Prophylaxis.—Under war conditions this is by no means easy. Alcohol must be eschewed, at least during the day, the skin kept clean, the clothes should be loose and easy and the head, especially the occiput and the nape of the neck, well protected. Spinal pads are useful. Arms and accoutrements should be as light as possible, water and, when they can be obtained, citron drinks taken freely and the bowels kept open.

Treatment.—The milder degrees of sun headache are benefited by doses of caffeine and antipyrin or caffeine and phenacetin.

For heat prostration get the patient into the shade, in a cool place if possible, lay him on his back, loosen his clothing especially about the neck and massage his limbs. If there is collapse give ammonia or camphor and restore his bodily heat by hot applications.

The special treatment for the asphyxial type of heat-stroke is artificial respiration prolonged if necessary for a couple of hours. This is stated to be the only remedy for this form.

The paralytic type also requires prompt and vigorous treatment. The indications are to reduce the temperature, to get rid of toxic substances and to prevent cardiac failure. Where ice can be got it must be used to bring down the temperature, an iced bath or ice pack or massage with lumps of ice being employed. A handy way is to lay the patient naked on a slightly inclined stretcher, ice-pack him and play a stream of iced water on his head from a distance of from 15 to 20 inches. This ice-cold stream must not be continued for more than one or two minutes and collapse must be guarded against. Hence the rectal temperature must be taken and the cold applications stopped when the thermometer registers 103° F. Thereafter

A rectal enema containing one drachm of chloral hydrate has been found useful in quieting wildly delirious cases./

wrap the patient in blankets and apply hot bottles to the trunk and limbs. If perspiration sets in the prognosis is good.

If the temperature shoots up again the cold applications must be resumed. Where ice cannot be got, a sheet soaked in dilute alcohol over which a draught of air plays may be tried or cold water enemata given. There seems to be an advantage in making these alkaline, *i.e.*, give $1\frac{3}{4}$ pints of a solution containing 2 per cent. sodium chloride and 2 per cent. sodium bicarbonate.

As there may be tissue acidosis slow intravenous transfusion of a similar quantity of a 1 or 2 per cent. solution of sodium bicarbonate is indicated when the patient does not quickly respond to the treatment by cold. Such cases tend to develop œdema of the lungs and brain, hence, before the transfusion, venesection should be practised as this will also help to eliminate toxic products. Normal saline may also be given intravenously after the bleeding.

Stimulants are often required, but strychnine is contra-indicated owing to its tendency to cause convulsions. When the latter occur give cautious inhalations of chloroform, watching the heart. Calomel and salines are indicated at a later period.

Treat psychopathic forms as for heat prostration and on general principles.

HEPATIC ABSCESS.

Under this heading only the so-called tropical abscess due to *Entamœba histolytica* and the result of amœbic dysentery will be here considered. With the addition of emetine to our therapeutic armature this condition, so serious if unrecognised, should rarely if ever occur but unfortunately cases, some of them fatal, have not been lacking, so a few notes on this, the most important sequela of amœbic infection, certainly seem advisable.

Etiology.

In all probability *E. histolytica* is conveyed to the liver from the bases of the dysenteric ulcers as a small embolus. Finding there a nidus in the capillaries it commences to reproduce and by elaboration of its toxins brings about a tissue destruction which, unless there is secondary bacterial infection, is not a true suppurative condition. Bear in mind that the condition may develop in cases which have *apparently* never suffered from dysentery.

Symptoms.

It may be said at once that in any man who has had a history of dysentery, especially if it has been proved to be amœbic, the occurrence of rigors, fever, night-sweating, pain or discomfort in the region of the liver, hepatic enlargement, uneasiness or pain in the right shoulder should suggest the possibility of hepatic abscess. Remember only a few of these symptoms may be present and that they may be very slight, or even altogether absent, but remember also that it is usually safe and easy to confirm a doubtful diagnosis by exploratory puncture with an aspirating needle.

The premonitory symptoms which it is even more important to recognise are general malaise, anorexia, foul tongue, irregularity of the bowels, high-coloured urine, irritable temper and insomnia. A little later a feeling of weight and fullness in the right hypochondrium may be present and there is often a dry cough. The temperature is hectic in type. The haggard look and muddy complexion are very suggestive to the trained eye and a history of uneasiness when trying to lie on the left side is frequently forthcoming. Still later there is often pain and just as this pain may be referred to the right shoulder so it may be referred to the appendix. When the abscess is in the left lobe the symptoms suggest gastric trouble. Jaundice is rare. The patient may walk as though he were supporting his abscess with his right arm. Measurements will show a difference of girth on the two sides and enlarged superficial veins are often visible.

Physical examination may also detect rigidity of the right rectus, tenderness and upward enlargement of the liver and crepitations or pleuritic friction at the base of the right lung. Pulmonary auscultation should never be neglected. Neither should a blood examination, the total leucocyte count and more especially the

differential count being important. There is an early pre-suppurative stage when hepatitis alone is present and where a leucocytosis exists together with only a slight increase in polymorphs, distinctly less than what occurs in septic bacterial inflammation. It is characterised by a low remittent fever. Once the abscess has developed the same conditions persist and though the mere leucocytosis does not help one much the comparatively slight increase in polymorphs, *i.e.*, 70 to 80 per cent. is distinctly suggestive.

In more chronic cases owing to a diminution in the red cell count there is a distinct *relative* increase in the leucocytes.

Morbid anatomy.

All that need here be said is that the favourite site is the superior and posterior part of the right lobe and near its surface and that though a single abscess is the rule, multiple abscesses are by no means uncommon.

Diagnosis.

When available the X-rays are useful for they enable the detection of diminution in movements of the right side of the diaphragm, an important early sign of acute hepatitis. They also show the *upward* enlargement of the liver when an abscess is present in the right lobe and may indicate a definite localised increase in the density of the liver shadow. Blood examination must not be neglected for, amongst other things, it may save one from plunging a needle into a leucocythæmic liver and thereby inducing a fatal hæmorrhage. Finally there remains exploration by the aspiration needle, the outer extremity of which will swing up and down like a pendulum if the needle has entered the liver.

Differential Diagnosis.

It is impossible here to mention all the conditions from which liver abscess has to be distinguished. Remember especially malaria and malarial hepatitis, inflammatory and suppurative states of the gall-bladder, hydatid cysts, appendicitis, tuberculosis and scurvy. The last named is specially mentioned as it has occurred amongst men in the M.E.F.

Treatment.

In the pre-suppurative stage and even apparently when the abscess has actually begun to form emetine given by the needle can effect a cure. A grain once, or perhaps better twice, a day should be given together with cautious purging by the sodium sulphate mixture mentioned under "Dysentery." If emetine cannot be got recourse must be had to ipecacuanha.

For local pain cupping, ammonium chloride in 20 grain doses thrice daily and the application of leeches round the anus are recommended.

The operative treatment for liver abscess is beyond the scope of this section, but mention may be made of the practice of aspiration combined with the injection of a solution of emetine, one grain to two ounces of water into the abscess cavity.

INSECT PESTS.

WINGLESS PESTS.

Under this heading the following insects are included:—Lice, Bugs, Fleas, Ticks and Ants.

LICE.

Diseases transmitted by.—Typhus, and relapsing fever. Lice also cause great cutaneous irritation.

The Clothes Louse (Pediculus vestimenti).

Also called the body louse. The female lays about 50 eggs in a period of two weeks, the eggs hatching in from eight to eleven days. The young lice, though much smaller, resemble the adults except for minor characters, and almost immediately upon emerging from the egg begin to suck blood, continuing to do so every few hours. During the course of a fortnight they moult several times and increase in size, becoming sexually mature at about the end of that period. Lice quickly die when separated from their host.

The eggs are laid among, and attached to, the fibres of the clothes, the female showing especial preference for seams and linings—a point of importance in considering the destruction of lice. These eggs are about the size of a small pin's head and are yellowish-white in colour, goblet-shaped, and firmly attached at the lower end to the cloth fibre by a cement excreted by the female (Fig. 5B).

Examination for Lice.—Persons suspected of harbouring body-lice should be examined first for the actual bites of the insect on the skin, which show as tiny punctures with small encircling areas of inflammation; the clothes should then be carefully examined, particularly the under-garments, with special attention to the seams and folds, where the eggs, if present, are most likely to be found.

Preventive Measures.—Many have been recorded, but few are really efficacious. Amongst the latter may be mentioned "Vermijelli," Oxford powder (practically "Vermijelli" in powder form), naphthalene, creosote, and iodoform ("N.C.I." mixture), vaseline and camphorated oil 10 per cent. When

^120/
twelve/ as many as 295 have been recorded./

become moribund/
days but this is exceptional/ It would seem that 10°C. is
about the minimal lethal temperature./

eggs on clothing may remain a possible source of infestation
for a month/ It should be noted that lice, under certain
conditions can do migrate from their host./

^ petrol or paraffin/

1 Railway steam disinfecting van (see p.)

1 Experiments have shown that a moist temperature of 55°C. (131°F.) is quite sufficient to destroy lice & their eggs (Babes)

2 p.

2 or by soaking for one hour in 1½ per cent cold solution of cresol which is said to kill both the lice & their eggs. Chloride of lime in a 7 per cent cold solution is reported to be effective in 24 hours.

Petrol can also be employed for garments can be thoroughly washed in boiling soapy water for five minutes.

using the latter it is advisable first to sponge the body of the patient thoroughly with a 1 in 1,000 solution of mercury bichloride, and, after drying, to rub the camphorated oil well into the skin.

Destruction of Clothes Lice.—Here again a great many different measures have been advocated, but lice in clothes are apparently best destroyed, together with their eggs, (1) by heating the clothes *en masse* in a suitable sterilizer such as the Thresh machine or in the barrel disinfectors exposed to current steam; care should be taken that the clothes are loosely packed in the sterilizer to ensure the penetration of the steam to every part of the garments. Eggs, when killed, are found to have lost their shiny appearance. (2) By sulphur fumigation. (See Sanitary Notes.) (3) By spraying them with petrol, paraffin, benzine, or 10 per cent. formalin, or simply by subjecting them —particularly the linings and seams in all cases—to a steam jet, such as can be readily obtained from a kettle. A hot iron passed over the clothing is most effective. (4) By washing with "Vermijelli," using the "Vermijelli" as soap.

Other preparations which have been used with success are:—Menthol powders: (i) Menthol gr., 5-10; Zinci ox. ad., ℥ i.; (ii) Menthol gr. 5-10; pyrethrum gr. 30–℥ j; Zinci ox. ℥ ij; talci ad. ℥ j; but they are somewhat expensive. Guaiacol and vaseline are also useful. The powders are sprinkled over the body and clothes and the vaseline is rubbed into the skin.

The Head Louse (Pediculus capitis).

Morphologically, and in almost all points of its life history, this parasite resembles the clothes louse, except (1) that it is a trifle smaller, and (2) that it is a parasite exclusively of the hair of the head (Fig. 5A).

Examination for Head Lice.—The head of the suspected person should be carefully examined for the actual parasites or their eggs. The latter—popularly known as "nits"—are minute yellowish-white, goblet-shaped bodies about the size of a "full stop" on this page, and are found firmly cemented to individual hairs. In the examination for head lice a fine tooth comb is of great assistance and should be used.

Preventive Measures.—The best safeguard from infestation is to wear the hair cropped close and to indulge when possible in frequent washing with carbolic soap or cresol soap solution. (Jeyes' fluid 1½ oz., soft soap 1½ lbs., water 10 gallons.)

Destruction of Head Lice.—The heads of infested persons should be thoroughly combed and treated with paraffin, petrol, soap liniment, white precipitate ointment, or benzine, and

then well washed with cresol soap solution, carbolic soap, or lysol. If the infestation is particularly heavy, and the exposure to re-infestation is constant, the hair of the head should be cropped short and maintained in that state.

The Pubic or Crab Louse (Phthirius inguinalis).

This parasite is rare and at first sight only resembles the two former lice in that it has the same habits of feeding, general life history and of clinging to the host by means of clawed legs. *P. inguinalis* infests the hairs of the pubis, and occasionally those of the axillæ and eyebrows. It is a much flattened creature, and the leg claws are particularly strongly developed, giving it the appearance that has led to its popular name (Fig. 5c).

Examination for P. inguinalis.—Infestation by this parasite causes intense irritation, and the bites being confined to a limited area often lead to extensive inflammation. The presence of the parasites can be ascertained in the same manner as that adopted for *P. capitis.*

Destruction of P. inguinalis.—Any of the above substances advocated in the destruction of the other lice are suitable. Vaseline and yellow precipitate (1 in 50) is, however, specially recommended in cases of infestation of the eyelashes and eyebrows.

THE BED-BUG.

Two species of bed-bug are important, *Cimex lectularius* and *C. rotundatus.* The former is the common bed-bug of northern latitudes, the latter the bed-bug of the tropics. Both have much the same habits and life-history.

Diseases transmitted by.—None definitely known but the bed-bug has been accused of carrying kala-azar, leprosy, tubercle, plague, anthrax, relapsing fever and typhus.

Cimex lectularius and C. rotundatus.

Both males and females suck blood, and they are nocturnal in their activities. During the daytime they usually hide in cracks in floors, walls and furniture, or in beds, among the folds of the sheets and blankets, in or below the mattress, or, in fact, anywhere where they may remain quiet and obscure until the night. Bed-bugs are capable of migration from house to house or from tent to tent and can live for long periods—nine months or more—without food, so that an infested place may remain so for a lengthy period.

The female lays a large number of eggs, which are deposited in clusters of 20 or more. A single female *C. lectularius* in captivity has been known to lay as many as 111 eggs in 81 days. There is no special season for egg-laying, and it continues throughout the year, the eggs being deposited in the hiding-places of the adults.

The eggs are a dirty white colour, about 1 mm. in length and ovoid in shape, the upper end having a disc-shaped cap (operculum) that projects more over one side than the other. The female bug attaches the lower end of the eggs by a gelatinous substance to the side of the crack or crevice in which she hides them. The larvæ hatch out in from four to nine days, and feed soon afterwards if a blood meal is available. Four or five days thereafter the larvæ moult and attain the first nymphal condition, and after four subsequent moults the adult stage is reached in about six or seven weeks from the hatching of the egg. Sexual maturity is attained from ten days to a fortnight later.

Examination for Bed-Bugs.—The walls, floors, ceilings and the contained furniture—particularly wooden beds and bedding—of suspected rooms should be carefully examined, especially obscure corners and cracks in the walls, &c., that are likely to prove hiding-places for the parasites. In the case of beds and bedding, special attention should be devoted to folds in the mattress and to the crevices formed at the junction of the bedstead units.

Preventive Measures.—In houses and tents that are liable to infestation the best safeguard is cleanliness and the removal of all possible hiding-places for the bugs, such as the filling up of cracks in the walls, &c., of houses. Bedsteads may be treated with paraffin, either in the form of a spray or by applying it with a rag. Vaseline is also excellent for the purpose. Wooden floors should be frequently scrubbed with hot water and soapsuds and powdered naphthalene may be dusted where the use of the water and soapsuds is inadmissible.

Destruction of Bed Bugs.—Infested rooms should, if possible, be subjected to fumigation by sulphur, using 2 lbs. of sulphur to every 1,000 cubic feet of space. If this is impossible a paraffin spray should be used, working over all possible hiding-places. The floors should be thoroughly scrubbed with hot water and a solution of strong soap and, after drying, may be advantageously dusted with a small quantity of powdered naphthalene. If none of these measures is possible, a paraffin or benzine blow-lamp may be used to kill the adults and their eggs in their hiding-places. The lamp should be pumped up to a strong blast and the flame directed against and rapidly moved over all sus-

pected places. In this way a temperature lethal to the bugs and their eggs is created, but, with the lamp moving rapidly, sufficient heat to injure the walls or woodwork of furniture is not forthcoming.

FLEAS.

Diseases transmitted by.—Plague and possibly kala-azar.

Fleas that commonly attack Man :—Pulex irritans and *Xenopsylla cheopis.* The female lays large eggs, singly, and these are not attached to the residential host but, when laid, fall to the ground. They are found most readily in the sleeping places of animals. In summer the eggs hatch in from 2 to 4 days, but in winter the incubation period may be extended to a fortnight.

The eggs hatch and an active footless larva emerges, dirty white in colour and sparsely clothed with long, fine hairs. It lives among dust, on floors, &c., feeding on organic matter. The larva attains its full development in about two weeks when the weather is warm, then seeks a quiet place and spins a cocoon, in which it pupates. The pupal stage extends over a period of about another fortnight, and the adult flea emerges.

Adult fleas are as a rule only too much in evidence, but in order to find the immature stages the dust from the floors of the suspected place should be brushed up and examined with a hand lens for the eggs, larvæ and pupæ described above.

Preventive Measures.—No dust or fine organic débris should be allowed to gather. Wherever possible all textile floor coverings should be abolished. The floor may with advantage be dusted with powdered naphthalene or pyrethrum powder (Keating's). Both these powders can be applied to the clothes to prevent attack by fleas. Pesterine and the tricresol powder mentioned under the section on plague are useful.

Destruction of Fleas.—Infested houses or dug-outs should be fumigated with sulphur, 4 lbs. to every 1,000 cubic feet, or with formaldehyde vapour, produced by adding 20 c.c. (about $\frac{2}{3}$ oz.) of formalin to 8 grams (about 124 grains) of powdered potassium permanganate. This will kill adults and all other stages. The house or tent, after thorough fumigation, should be carefully swept of all collected dust.

TICKS.

While ticks are responsible for the transmission of one or two serious diseases in tropical Africa and America, so far as the Near East is concerned they need not be considered except in regard to the larval stage of one sub-family (Ixodidæ), which is often a serious nuisance on account of its habit of burrowing into the skin of persons who have come in contact with it (Fig. 6).

The Itch Insect.

Sarcoptes scabiei, the cause of itch, proves itself such a nuisance to armies in the field when been so prevalent in the Salonika area that, without entering into any minute account of this troublesome mite, it is advisable to say something regarding it. The female is larger than the male ♂, as is so usually the case in the insect world, she causes nearly all the trouble. The males live on the surface of the skin and soon after mating both the female ♀ and the spikes in, usually in places where the skin is thin. During life she lays her eggs, as a rule about 2 dozen of them but as many as 50 have been recorded. She continues at the double work of excavation + egg-laying for 2 or 3 months when this ceases and she herself becomes purposeless. After about 7 days the eggs hatch into six-legged larvae, these moult & become eight-legged nymphs; after a double moult the nymphs form sexually mature male + the so-called pubescent females. Pairing takes place, the males die, the females make their skins, become injurious and resume their excavations. The whole cycle lasts about 28 days. In hot weather the mites increase + infection becomes much more extensive. The irritation is chiefly due to the young females moving about at night on the surface of the skin. The intolerable itching, however, + in this way various complications may arise, [illegible] infection. Personal contact is not the only method of infection. It has been found that the mites can survive away from the body for as long as 10 days, provided the air is warm →

and wash.

Treatment. 1. Strip patient naked + rub all over (except the head) for 20 minutes with green soap + warm water.

2. Place him in a warm bath for 30 minutes + go on rubbing.

3. Rub in the parasiticide, sulphur ointment naphthol or Balsam of Peru (expensive) for 20 minutes + allow it to remain on the body for 4 or 5 hours. Meanwhile sterilize the patients' clothes in a Thresh disinfector or Serbian barrel.

4. Give a final bath to remove the parasiticides.

The sulphur inunction treatment may take a fortnight to effect a cure, hence a new plan has been devised i.e. placing the patient in a cabinet constructed on the lines of a home Turkish bath, and there subjecting him to sulphur dioxide gas generated by a large Jeyes' sulphur candle. The preliminary treatment is the same as above but fumigation takes the place of the inunction. He is left for fifty minutes + escape of fumes from the cabinet is prevented by applying a wet towel round the patient's neck where it emerges from the lid of the box. This treatment is said to be very efficacious to cure at one sitting + to afford great relief.

The cabinet has a covering of canvas to protect the wearer from sun or rain + its interior is lined with thick brown paper + with felt at the roof junctions.

Boots + leather articles are sprayed with formalin, odd clothing disinfected as above. (Bruce-Hodgson).

The female tick lays her eggs in the earth (preferably damp), and these hatch and emerge as tiny, six-legged larvæ, brown in colour and about the size of small pin heads. These larvæ seek long grass and climb the stems until they come to the upper ends. Here they rest until an animal that may serve as a host chances to pass and brush against the grass, when they are often transferred in large numbers to the prospective host. In the larval stage almost any animal will serve this rôle, man being no exception, the larvæ apparently finding that his clothes afford an excellent means of transference. They immediately burrow through the clothing to the skin, where they attach themselves by means of the rostrum or proboscis that projects from the head. When force is used in the attempt to remove the attached tick one of two things happens—either the surrounding skin is unnecessarily torn or, as is most probable, the head of the tick is ruptured, the rostrum remaining buried in the skin. This sets up severe irritation, and may even lead to septic infection; therefore, rather than forcible removal, the following course is advocated where time permits.

A small camel's hair brush should be dipped in turpentine, benzine, petrol or paraffin and applied between the skin and the under surface of the tick. After a few moments the tick will let go its hold, being killed by the application, and may be swept from the skin with the brush. Any other oil may be used for the same purpose and vaseline smeared over the tick and surrounding skin is equally efficacious. To remove a rostrum that remains in the skin after a tick has been forcibly removed, cocaine should be applied to the spot and the rostrum extracted with needle forceps, the spot afterwards being antiseptically treated.

ANTS.

As regards this group it need only be remarked that ants have been incriminated experimentally in the spread of typhoid and cholera and emphasis should be laid on the fact that food must be protected from their predations. Ants may travel from infective material to foodstuffs, carrying with them pathogenic organisms and making it essential that food be placed out of their reach. This is especially important when cholera is present.

Ants may be kept from food on tables by tying paraffin-soaked rags round the legs of the latter. Kill the insects by the use of Keating's or other insect powder, such as borax.

To avoid the incursions of ants into tents and houses, &c., all food scraps should be destroyed, stores carefully protected, and all "ant-routes"—the established paths by which the ants find

entry and exit—should, as far as possible, be blocked up and sprayed with paraffin or powdered with borax. If practical, the nest should be traced by the "route," and destroyed by digging up the soil over and around it for several inches, pouring in about a pint of petrol or paraffin and setting the latter alight.

WINGED PESTS.

Under this heading Mosquitoes, Sandflies, Midges, House-flies, Stable-flies, Carcase-flies and Hippobosca are included.

MOSQUITOES.

Diseases transmitted by (in the war area).—Malaria, dengue fever, and possibly so-called Mediterranean yellow fever. The common European anopheline known to transmit malaria is A. maculipennis (Fig. 7).

The Anopheline Mosquitoes.

Among mosquitoes of this sub-family are included those that transmit malaria. They are characterised by their spotted wings and by the fact that the palps of both male and female are long. The male may be distinguished from the female by its densely hairy and plume-like antennæ, those of the female being not nearly so thickly clothed with hairs (pilose). The female alone sucks blood, and after a meal she seeks a quiet place in which she can digest the blood while her eggs rapidly mature in her ovaries. In the course of a few days she makes for water, where she lays her eggs singly or in star-like clusters on its surface. The eggs are cigar-shaped, and each has a small swelling on either side serving as a float. After a few days the eggs hatch and minute, active larvæ emerge, which, owing to their transparency and small size, are at first difficult to see, the so-called "wrigglers" (Fig. 9).

When the larva is feeding or frightened it remains submerged at a depth, but when resting or taking in fresh air supplies it lies just below, and parallel to, the surface. This parallel position is another important anopheline character, distinguishing their larvæ from nearly all others. The larvæ feed and grow rapidly, undergoing three moults. The time spent in the larval condition depends partly on the temperature of the water and partly on the food supply, but with both favourable this con-

Some anopheles, however, like a. bifurcatus found in the Salonika area, ~~are dark-winged~~ & the a. lutzii of Mesopotamia are clear-winged. While large mosquitoes of the genus Theobaldia & the wing membrane spotted & in this respect resemble [illegible]. Most anopheles show the spotting on the outer [illegible] border of the wing & may easily be told as "Banded".

dition is passed through in about a week or ten days. The fully grown larva then casts its skin and attains the pupal condition when in shape it appears like an overgrown comma. The pupa swims by active strokes of its tail and at rest lies just below the surface, breathing through two small tubes or so-called "trumpets," that are situated at the sides of the head and which just break the surface film. The pupal stage lasts about a week, and then the pupal case splits and the perfect insect emerges.

The Culicine Mosquitoes.

In this sub-family are included the mosquitoes responsible for the transmission of dengue fever and possibly Mediterranean yellow fever, such as *Culex fatigans* and *Stegomyia fasciata* (*Aëdes calopus*) (Fig. 8).

Speaking generally, culicine mosquitoes may be distinguished from anophelines—In the adult stage : (1) by the wings not being markedly spotted, particularly along the front edge of the wing; (2) by the fact that the male only has palps as long, or nearly as long, as the proboscis, the palps of the female being very short and appearing as two small projections at the junction of the proboscis with the head; (3) by the resting attitude, culicines resting parallel to the surface while anophelines appear to stand on their heads. In the larval stage : (1) by the position the larva takes up when at rest at the water surface, the anopheline larvæ lying parallel to it, while the culicine larvæ hang head downwards; (2) by the fact that the culicine larva possesses a breathing tube at its posterior end, this being absent in the case of anophelines (Fig. 9).

The pupal differences are very slight.

Preventive Measures.—In order to prevent the breeding of mosquitoes care should be taken as far as possible that no waste water be allowed to collect and stand, and all small reservoirs, such as tanks and cisterns of fresh water, should be adequately protected by tight-fitting covers, and such covers kept in good repair. Old tubs, bottles and tin cans in the open that might catch rainwater should be abolished, small pools and ditches should be drained and filled up with earth.

Pools that are too large to drain or fill up should have any aquatic growth destroyed and removed as much as possible and be treated with paraffin or with 1 pint paraffin or kersosene to 2 of crude petroleum oil, using about ½ pint for every 100 square feet. This should be done at least once a week.

For ditches and camp drainage gutters drip-cans may be established, discharging about 20 drops of the oil per minute. These are easily made either by puncturing a paraffin tin with a nail

and inserting a wick of cloth or tow or by inverting a corked bottle filled with the oil and puncturing the cork. Both kinds of containers should be mounted on some sort of platform over the centre of the water-course. (*See* Sanitary Notes.)

Where there is no danger of poisoning to men or animals, Sanitas-Okol may be employed, using 1 in 10,000, or 1 oz. of crude carbolic acid per 10 cubic feet of water.

When feasible, houses should be screened and mosquito nets used (18 meshes to the linear inch).

As repellants, the following are recommended :—

(1) Citronella oil in vaseline.
(2) Oil of bergamot in kerosene (1 in 16).
(3) 50 per cent. alcoholic solution of thymol or oil of cloves, in lanolin.
(4) Cassia oil as recommended by Howlett.

It is said that 1 oz. of Epsom salts dissolved in ½-pint of water, dabbed on the skin and allowed to dry on it, will prevent mosquitoes from biting.

Destruction of Mosquitoes.—Rooms, dug-outs and tents that are infested with these insects may be fumigated with sulphur, formaldehyde or cresol. The latter substance is best vapourised in a shallow container over a lamp or other source of heat, using about 4⅓ ozs. per 1,000 cubic feet.

SANDFLIES.

Diseases transmitted by.—None definitely known, but the bites of these minute bloodthirsty flies are particularly severe and painful when they attack in large numbers. The flies are likely to be met with during the spring and summer in the Balkans.

The Simuliidæ (sometimes popularly known as sandflies and also called buffalo gnats) are small dark, hump-backed flies, ranging in size from about a large pin's head to about one-eighth of an inch in length (Fig. 10).

The female simulium, which has a short but formidable proboscis, lays her eggs in gelatinous masses on water weeds and stones in running streams; these hatch and small peculiar larvæ emerge which have a sucker at the posterior end of the body by which they attach themselves to stones or weeds in the stream. The pupæ are enclosed in a kind of cocoon. The cocoons and enclosed pupæ are also attached to stone or submerged water weeds.

Preventive Measures.—The elimination of simulium from a district is too great a problem for consideration in a war area. To keep off the adult flies—only the female of which, as a rule, bites—some repellant may be used, such as a lotion of an essen-

Vermiselli

tial oil made up with quinine or an infusion of quassia. Citronella oil and oil of bergamot have also been recommended. For other insect repellants see section dealing with mosquitoes.

MIDGES.

One genus only need be considered, viz., Phlebotomus, species of which are known in Southern Europe sometimes as "Sand Flies" or "Pappataci Flies."

Disease transmitted by.—"Pappataci Fever" or "Three-day Fever."

Phlebotomus.

Small flies having the wings and body very thickly covered with hairs (see section on Phlebotomus Fever). In most species only the female sucks blood and though the flies are minute their bites cause very severe irritation. On the slightest disturbance the insect by short rapid flights suddenly moves to left or right, suggesting to some extent the movements of a flea. Its small size enables it to creep through the mesh of ordinary mosquito nets.

The fly breeds in damp places where there is rotting vegetation, such as dark and damp cellars, caves, cracks and fissures in soil, under damp stone walls, in tunnels, &c. The egg hatches and gives rise to a minute caterpillar-like larva, whose body is studded over with spines, and bears several long hairs at the posterior end. The larva lives on decomposing vegetable matter and when fully grown pupates, the perfect insect emerging some days later.

Preventive Measures.—Use of a fine mesh net. Employ repellants, such as eucalyptus oil, or camphor. Howlett has recently found that cassia oil is the best application. (See section on Phlebotomus Fever.)

Destruction of Phlebotomus.—No satisfactory measures can be advocated beyond trapping the adults and the possible destruction of places likely to act as breeding grounds. Among these may perhaps be particularly mentioned old and damp latrines. Rooms and dug-outs may be fumigated by sulphur.

HOUSE FLIES.

Diseases transmitted by.—The common house fly (*Musca domestica*) is definitely known to distribute certain pathogenic bacteria and protozoa and to contaminate food by carrying the

organisms on its body, wings and legs, or depositing them by regurgitation or in its droppings. The lesser house fly (*Fannia canicularis*), so common at Mudros in the summer, has the same filthy and dangerous habits as Musca domestica.

Musca domestica. (Fig. 11.)

Finds a favourite breeding-place in human excrement, in manure, scraps of food and offal and filth generally, provided it is fairly moist. The female lays a large number of eggs, each of which is white, sticky, shiny, cigar-shaped and can be seen by the unaided eye (Fig. 12). They are usually deposited in batches on the surface of the breeding place and hatch in from one to four days according to the temperature. The larva is a small footless maggot, cream coloured and tapering anteriorly to a fairly sharp point (Fig. 13).

The larvæ feed on the decomposing material in which they have hatched and when the weather is hot become fully grown in about five days. They then migrate from the food, and, if possible, work their way down into the subjacent and surrounding earth, where the body shrinks to an elongated barrel shape. They may be found at a depth varying from a few inches to several feet, according to the nature of the soil. The outer skin hardens slowly and later takes on a deep brown colour forming the pupa case or puparium (Fig. 14). The pupal stage lasts from three to five days under favourable conditions and the fly then emerges, working its way through the soil to the surface. At first the wings are crumpled and folded, and until these expand the flies are often to be seen running over the breeding-ground, looking at a short distance very much like small spiders. About an hour after emergence the wings are fully expanded and a little later the fly is capable of flight.

Preventive Measures.—Abolish all possible breeding places. Protect all larders, food and latrines by screens, nets, &c. Foodstuffs in jugs and basins should be guarded by mosquito-net covers, such as can be readily made from mosquito-netting by cutting out pieces the requisite size and attaching small weights or beads along the edges. These can be thrown over the mouths of the vessels containing food. Guard against flies getting on to the lips and into the mouth when asleep in fly-infected places by the use of head nets.

Refuse should be burnt or deeply buried and the earth stamped down firmly upon it. If this is impossible it may be thoroughly sprayed with borax sodium arsenate solution, consisting of 13 ozs. borax, 7 ozs. sodium arsenate in 1 gall. of

The last mentioned is the method which has ~~[illegible]~~ proved to result in another type of [illegible]

In [illegible] this has actually been known to result in the [illegible] from a cycle of 10 days.

It has been found that under any favourable conditions the whole of the ~~life-cycle~~ developmental life-cycle may be accomplished in so short a space of time as 5 days.

The ingenious Japanese and Swiss traps should be so placed that there is a dark background behind the slit of entrance while a bright light falls upon the slit leading to the metal cage.

Two per cent ultramarine is useful for this purpose.

water or drenched with kerosene or solar oil. (*See* Section on Camp Sanitation.)

Destroy flies by :—

1. *Traps*, including "Tanglefoot" and other sticky fly-papers. A useful formula is 5 parts castor oil and 8 parts resin, the mixture being well boiled. The traps of various kinds may be baited with a mixture of one part milk and two parts brown sugar thoroughly mixed, or with food possessing an attractive odour—meat, fish, &c.

2. *Poison-baits*, such as a mixture of milk 20 per cent., formalin 5 per cent., water 75 per cent., with a little sugar added to it.

This should be spread about on tables, shelves, &c., in the form of droplets. Arsenite of soda used in a solution as follows : 1 lb. arsenite of soda, 10 lbs. sugar in 10 galls. of water. Strips of canvas, frameworks of knotted string or small branches of some tree or shrub whose leaves will remain on when they dry, should be dipped in this solution and hung up in safe and convenient places. This mixture, where there is no danger of animals being poisoned, can be sprayed over refuse and fly-breeding places. It can also be placed in shallow pans in latrine buildings.

3. *Poisons*, including Keating's or pyrethrum powder, which is best placed on the sashes of windows, and blown on to places where flies congregate. The arsenical fly-papers, which only require damping and exposure on plates to be effective, can also be used.

Flies on board ships can be got rid of by "Clayton" fumigation.

The Lesser House Fly, (Fannia canicularis). (Fig. 15.)

This fly resembles *Musca domestica* except that it is somewhat smaller, and specially frequents latrines.

It usually breeds in old vegetables or vegetable refuse but a favourite breeding ground is human fæces. The larva is a peculiar dirty-white coloured creature, possessing tassel-like processes from each segment of the body, shown well in the accompanying illustration (Fig. 16). The other stages and details of development resemble those of *Musca domestica*.

Since the larvæ of this fly often live in vegetables they

sometimes find their way alive into the human intestine, thus causing a form of intestinal myiasis.

Preventive and Destructive Measures.—As for *Musca domestica*, except that the favourite breeding place of this fly must receive special attention.

The Stable Fly (Stomoxys calcitrans). (Fig. 17.)

As will be seen this fly is rather like the house-fly but it has a spotted abdomen and is a blood-sucker, being furnished with a stout proboscis.

It commonly attacks animals, biting mules and horses about the fetlocks and drawing scarlet beads at every thrust. It is said to carry the virus of poliomyelitis.

CARCASE FLIES.

Under this term several genera are considered, including the "Bluebottles" (Cynomyia, &c.), the "Greenbottles" (Lucilia, &c.) and Sarcophaga—the hairy, grey-coloured flies found on decomposing material.

Diseases transmitted by.—It is more than probable that the "Bluebottles" and "Greenbottles" convey bacteria and protozoa to food stuffs in the same way as does the house-fly. Worse still, in the war zone, these three classes of flies are responsible for the cases of external myiasis (wound infection) that have been commonly met with in France and elsewhere during the present campaigns.

"Bluebottles."

This term, which includes several genera, is applied to flies whose bodies have a deep blue metallic lustre. They are the largest of the metallic lustred flies and the body and wings are in addition somewhat hairy.

"Greenbottles." (Fig. 18.)

This term also includes several genera, but is applied to rather smaller flies, whose bodies show a very bright metallic lustre, ranging in shade from a vivid blue-green to a green-bronze, and they are not so hairy as the former flies. During the summer Lucilia were fairly common at Mudros and could frequently be seen feeding in open trench latrines.

Sarcophaga. (Fig. 19.)

These are grey, very hairy flies with three dark longitudinal lines on the thorax. The different species vary greatly in size, from about the size of *Musca domestica* to the largest of flies commonly encountered.

The life-history of these insects corresponds in most details, except that in some species of Sarcophaga the female gives birth to living larvæ and does not lay eggs. The larvæ are deposited on the carcase or other food.

Female "Bluebottles," "Greenbottles" and some Sarcophaga deposit numerous white, cigar-shaped eggs on decomposing material, which is a carcase for choice, and these hatch very rapidly to small active cream-coloured larvæ or maggots (Fig. 20). The maggots feed voraciously and by means of two powerful claws that are situated within the mouth, and can be protruded, are able to tear and consume all animal tissues, including soft bone, at a truly remarkable rate.

With a plentiful food supply and warm weather the larvæ attain full growth in a few days, then migrate, if possible burrowing into the earth, where they pupate, emerging as flies some days later.

So long as they confine their attentions merely to carcases and other decomposing material these insects may be considered harmless and excellent scavengers; but in war time they often lay their eggs or larvæ on exposed wounds. The larvæ attack the living tissues, burrowing oftentimes deeply and causing great damage which sometimes leads to fatal results.

When wounds are infested by these parasites the latter should be removed as speedily as possible by means of forceps, or, when infesting cavities, they should be syringed out with some disinfectant solution. If possible they should be subjected to chloroform vapour before this is done in order to stupefy them and enable the solution more readily to wash them out. Solution "C" is valuable for killing and repelling carcase flies.

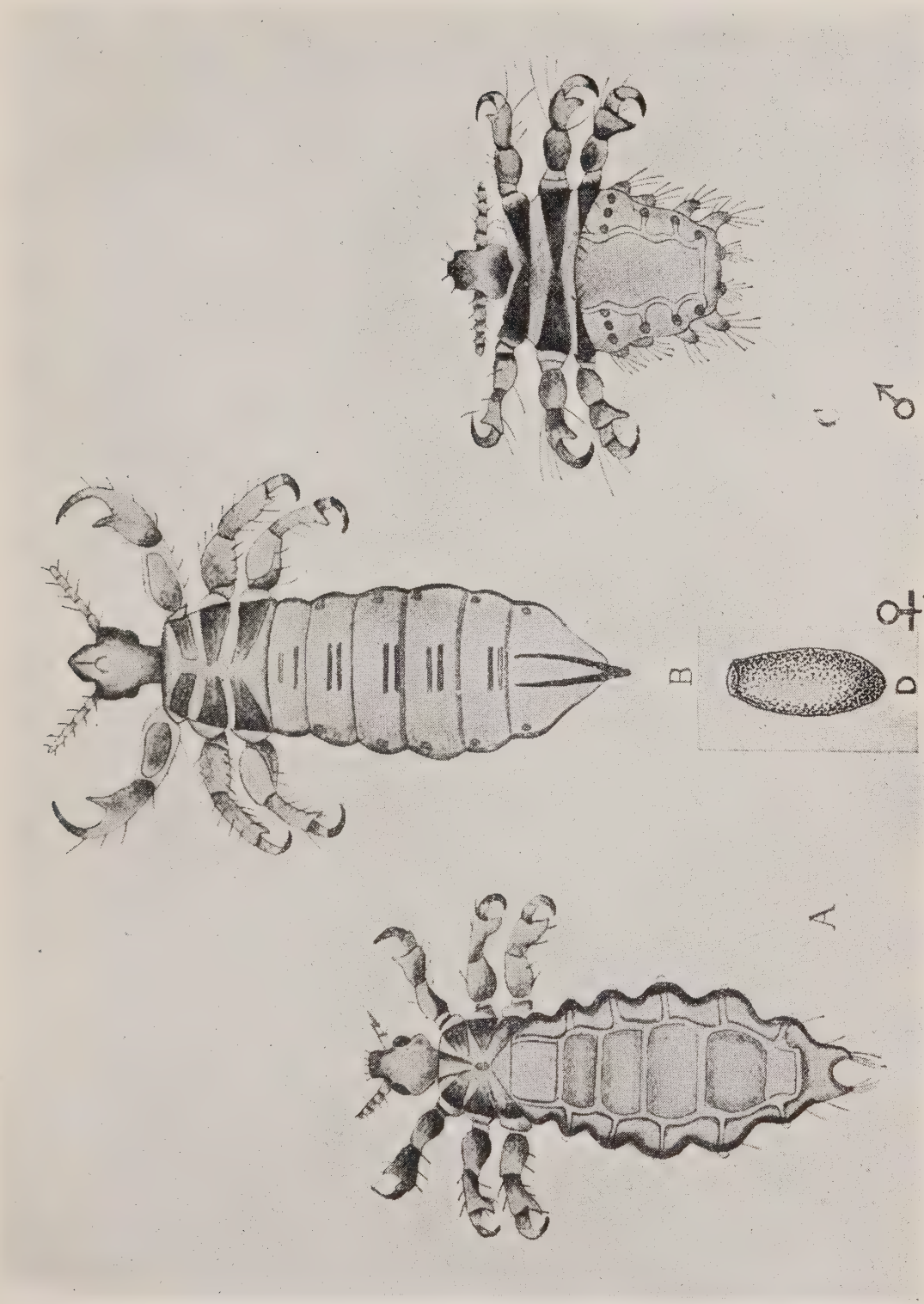
HIPPOBOSCA.

On horses and other animals in Egypt, Lemnos, the Gallipoli Peninsula and elsewhere in the Mediterranean war area there will often be noticed dark, flat, leathery, yellow-marked, ugly-looking flies, which at a distance resemble ticks.

These are the Hippobosca, which suck the blood of cattle and horses, but do not attack man. They will often be found clustering under a horse's tail, and cause the animal much discomfort. When disturbed they shift about on the skin in a

sidelong, crawling manner like that of a crab. Occasionally they will settle on a man or his clothes, where they cling closer than a brother and give rise to a sensation of loathing. They are easily caught by the hand and are best killed by pulling off their heads, their hard leathery bodies being very resistant to pressure.

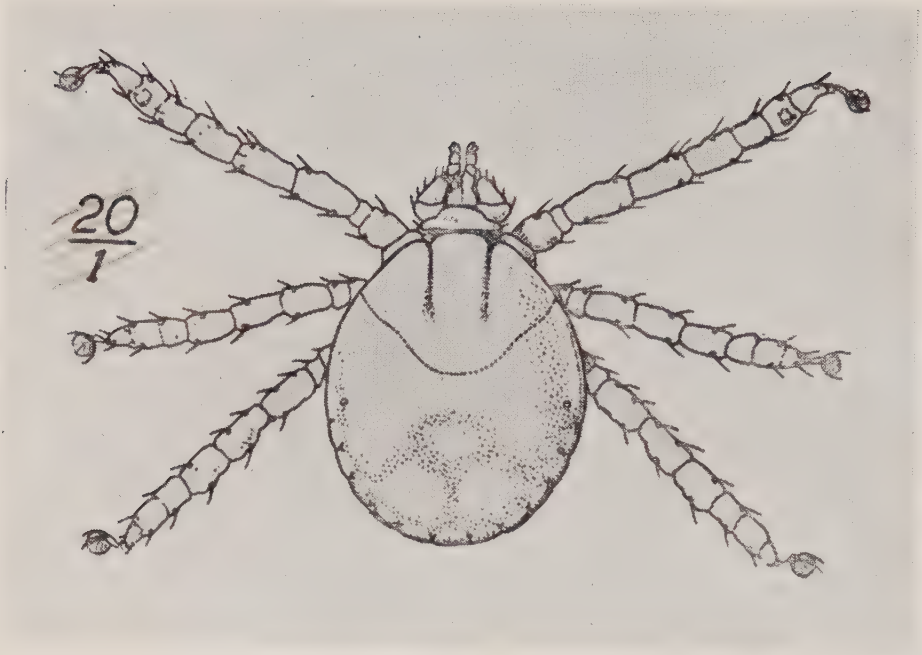
Fig. 5.



Human lice. A—Head louse; B—Body louse; C—Crab louse; D—Egg of P. vestimenti. Modified after Ealand.

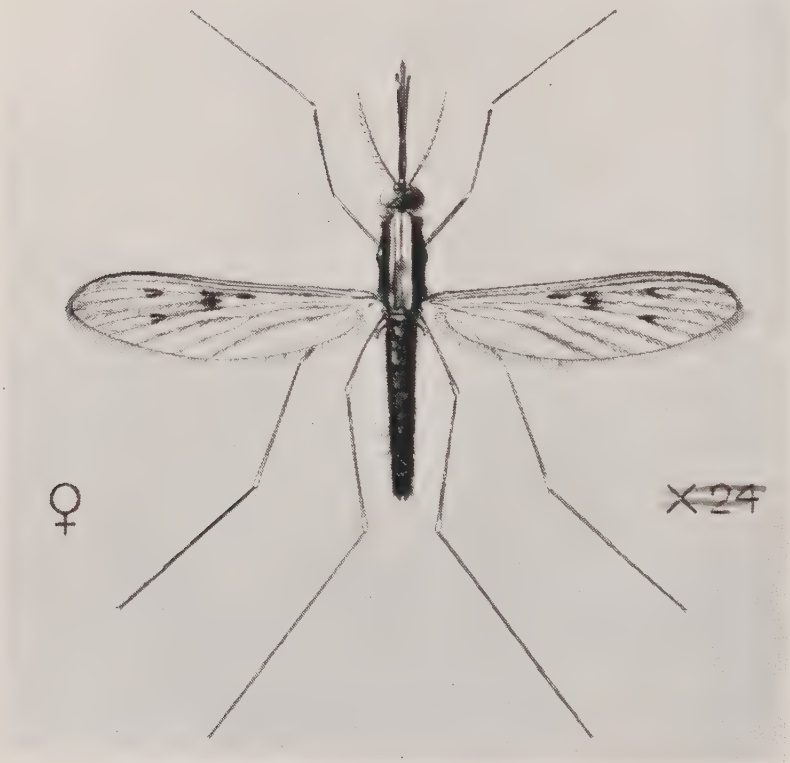
To face p. 58.]

Fig. 6.



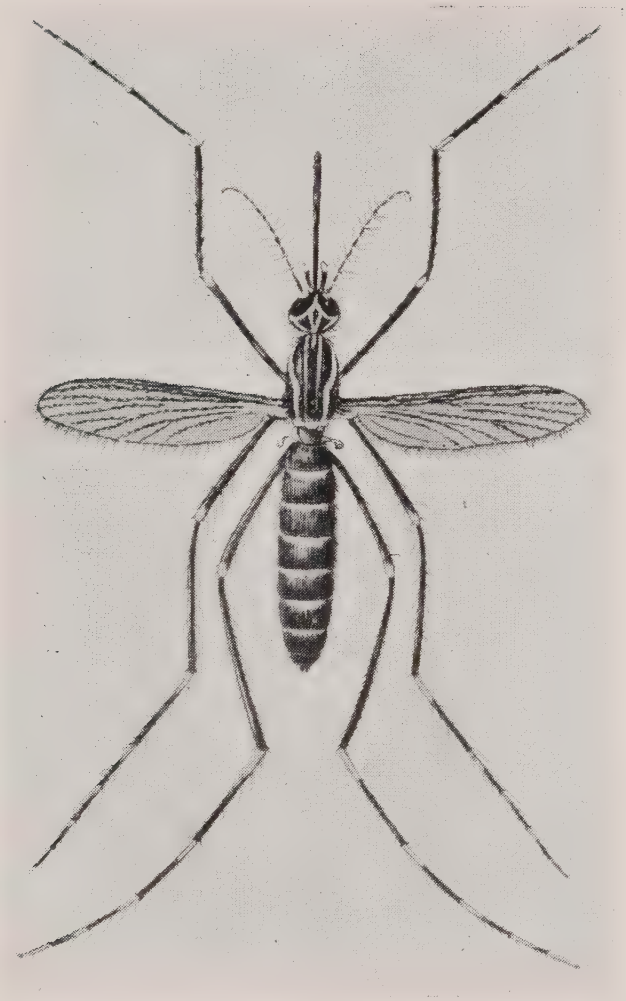
Tick larva. After Castellani and Chalmers.

Fig. 7.



Anopheles maculipennis (Meigen). After Terzi.

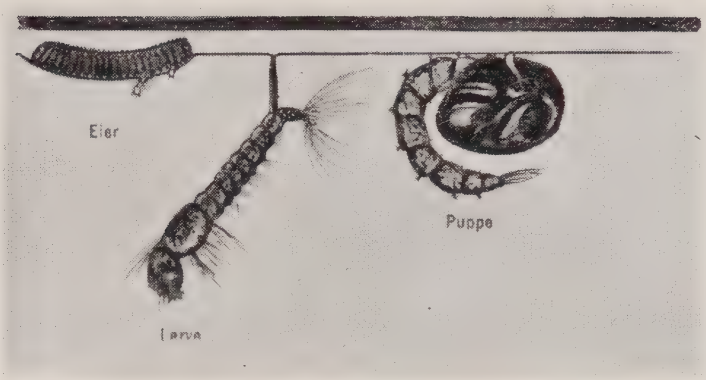
Fig. 8.



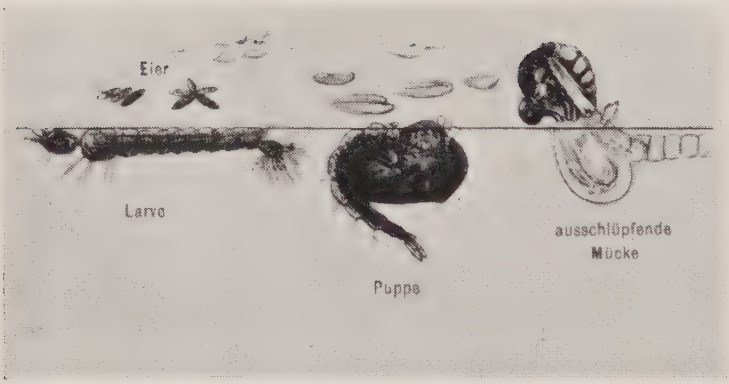
Stegomyia fasciata: Female (× ~~10~~). After Patton and Cragg.

greatly enlarged

Fig. 9.



Culicine egg-boat, larva and pupa.



Anopheline eggs, larva, pupa and emerging mosquito.

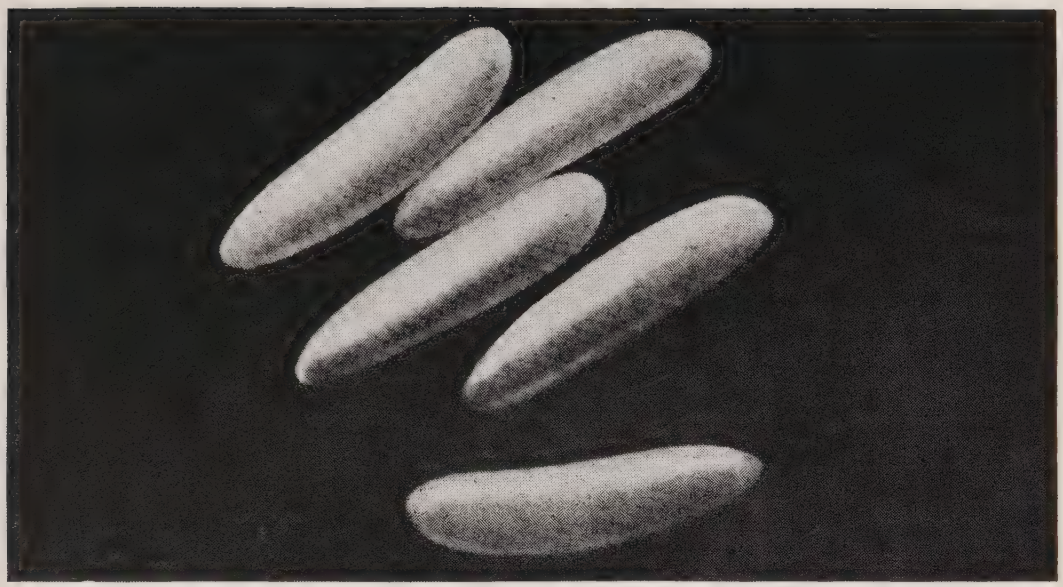
Fig. 10.

Simulium striatum, greatly enlarged. After Patton and Cragg.

Fig. 11.

The house fly—disease carrier. After Howard.

Fig. 12.



Eggs of house fly, greatly enlarged. After Newstead.

Fig. 13.

Larva of house fly. (× 10 diam.) After Gordon Hewitt.

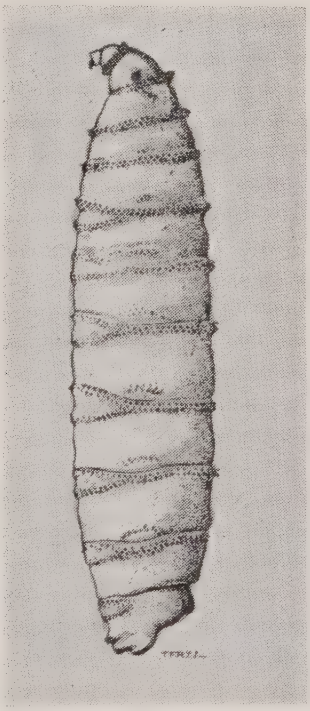
Fig. 18.

Lucilia cæsar, much enlarged. After Terzi.

Fig. 19.

Sarcophaga carnaria : Female (× 3). After Castellani and Chalmers.

Fig. 20



Larva of Sarcophaga *sp.*
After Castellani and Chalmers.

It is now known to be a human spirochaetosis due to the Spirochaeta ictero-haemorrhagiae recently discovered in Japanese cases of the disease.

JAUNDICE.

Three chief types of jaundice are known to occur amongst the troops forming the Mediterranean Expeditionary Force. These are 1. Catarrhal. 2. Catarrhal accompanying and complicating infective conditions. 3. Toxic or so-called Camp jaundice; also commonly known as Epidemic or Infectious Jaundice. In addition to these it is possible that sooner or later the so-called Mediterranean yellow fever or Weil's disease may be encountered. This ~~may either be regarded as a form, and sometimes a malignant form, of toxic jaundice or better perhaps is to be considered as a disease *sui generis* the etiology of which is obscure.~~

1. Catarrhal Jaundice.

This is probably always due to an extension of a gastro-duodenal catarrh induced by chill, exposure, dietetic disturbance, &c. It may be accompanied by slight fever.

Treat by calomel and salines. Avoid violent purges. Bismuth and bicarbonate of soda are indicated together with a simple and bland diet largely free from fats. In hospital practice irrigation of the large bowel with cold water may be tried in obstinate cases. This is said to induce peristalsis of the gall-bladder and duct and aid in the expulsion of mucus.

2. Catarrhal Jaundice associated with infective conditions.

Of the latter the most common in the Near East are paratyphoid-dysentry, enteric fever, malaria and relapsing fever. Remember that the jaundice may mask a mild paratyphoid infection. Treat the accompanying condition and deal with the jaundice as in the simple catarrhal form.

3. Toxic Jaundice.

There seems little doubt but that this is due to a definite bacterial infection. The exact causal organism is unknown but some have described one of the coli group as being concerned in its etiology and others think that a *Bacillus proteus* is concerned. An icterogenic form of the paratyphoid bacillus has also been described. Two French observers have recently isolated an anaerobic, icterogenic bacillus from the liver which, when inoculated into animals, has yielded suggestive results. Where facilities exist hæmoculture should be carried out in cases of this disease as it is important to investigate it thoroughly. The stools and urine might also be examined bacteriologically with advantage.

In war time this is a disease undoubtedly associated with insanitary camp conditions. It was much in evidence during the Civil War in America and no less than 5,648 cases of jaundice occurred during the South African campaign, a considerable propor-

tion of which answered to the so-called "epidemic or "infectious" type. The method of infection is unknown but whatever may be the case in Weil's disease it is very doubtful if biting insects, such as mosquitoes, play any part in the etiology of ordinary infectious jaundice. It would seem much more probable that infection takes place through the respiratory or alimentary tract. In this connection flies, such as the Muscidae, may play a part by infecting food. The disease is nearly always benign but it often proves very debilitating and frequently necessitates convalescents being sent to England to recuperate.

The attack may be preceded by either diarrhœa or constipation and the illness usually commences suddenly with rigor, abrupt rise of temperature, vertigo, headache, lassitude, insomnia, loss of appetite, nausea, it may be vomiting, pains in the back and legs and a coated tongue. Occasionally delirium is present. These symptoms issue in the stage of primary fever. Two other stages are generally described, those of jaundice and of secondary fever but the latter may be altogether absent. At first the temperature, the general and varying course of which is shown in the accompanying charts, is high—about 103° to 104° F. It remains so for several days and the patient may suffer from considerable pain in the epigastrium and right hypochondrium while the liver and spleen are found enlarged, the urine often albuminous and sometimes containing hyaline and epithelial casts and even red blood corpuscles. The jaundice stage begins from the third to the sixth day of the illness, the first tinge appearing on the conjunctivæ. It soon becomes general and may be so intense that the patient assumes a bronzed appearance. This may persist for a month or more. Usually, however, the jaundice lasts from 7 to 9 days. About the fifth day the temperature falls rather abruptly and attains the normal in from 4 to 6 days when the hepatic and splenic enlargements and the albuminuria disappear. The pulse is rapid in the primary stage but becomes slow when the jaundice is established. The stools vary in consistence, a little diarrhœa being not infrequent. Later they are clay coloured or white and constipation is the rule.

The secondary fever when it occurs lasts from 7 to 9 days but sometimes an elevated and irregular temperature runs a course for three weeks or more. In such cases it is probable that a paratyphoid infection is also present. The relapse generally sets in 3 to 8 days after the temperature has fallen to normal and it is as a rule milder than the initial attack.

The complications which have been noted are coryza, erythematous and urticarial eruptions, herpes labialis, erythema of tonsils and fauces ; cutaneous, gingival, conjunctival and retinal hæmorrhages ; epistaxis, hæmoptysis, hæmaturia and melæna ; parotitis, laryngeal paresis, neuritis and iridocyclitis. Some of these may have been due to associated diseases, *i.e.*, paratyphoid. Marked cardiac enlargement has been noted in cases recently treated at Alexandria.

The disease causes great loss of flesh and of bodily power and often induces mental depression. The muscle pains may persist during convalescence, which is slow if sure.

is now, as stated, known to be

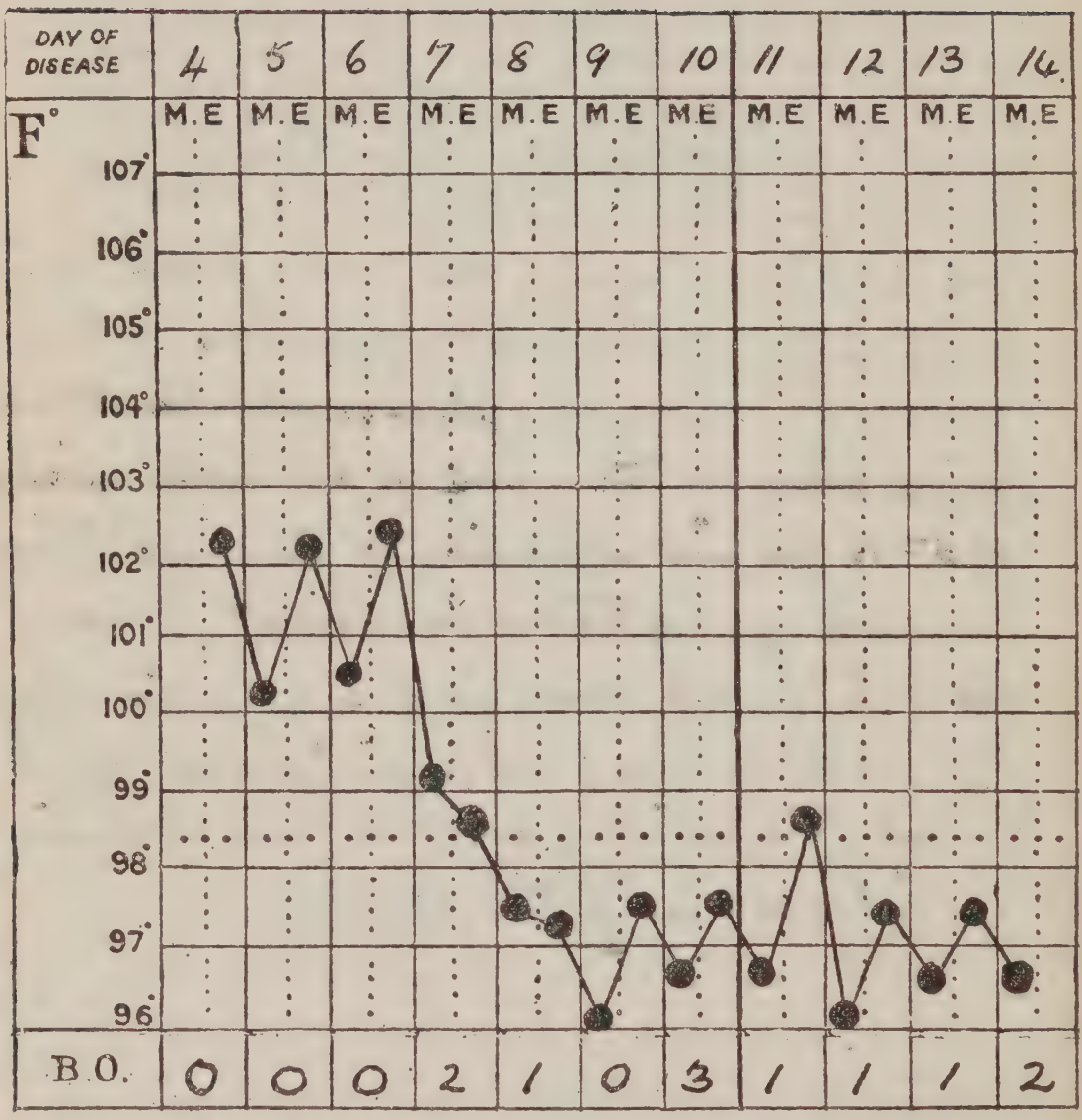
due to a special spurchase but the method of
conveyance of the letter has not yet been deter-
mined.

The treatment is entirely symptomatic. There is no specific drug.

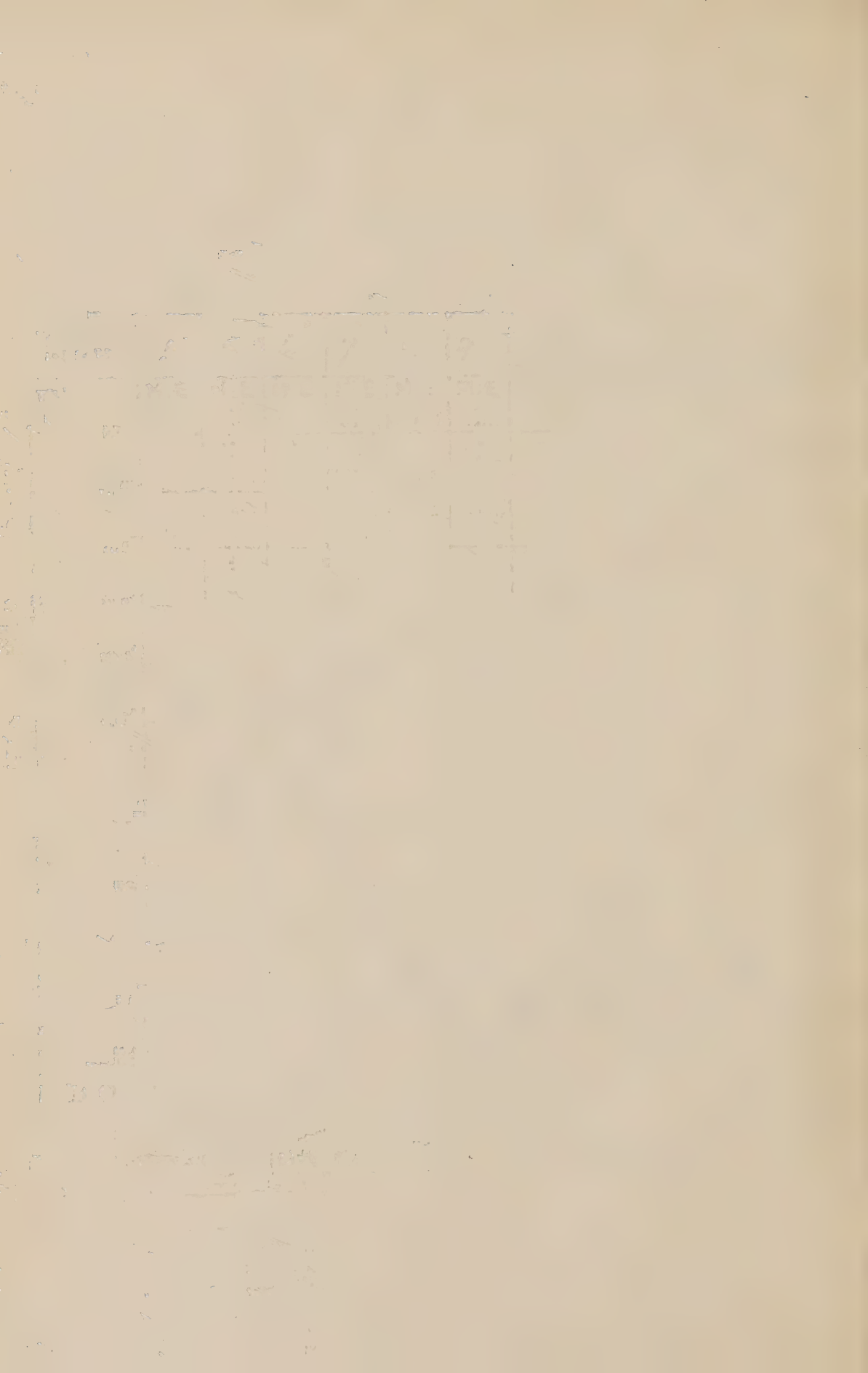
If we regard Mediterranean yellow-fever, the so-called Weil's disease, as a specific entity, we may note that there is a possibility of its transmission by means of such mosquitoes as *Stegomyia fasciata*, *Culex fatigans*, and *Culex pipiens*, all of which are found in the Gallipoli Peninsula. The symptoms closely resemble those of epidemic or infectious jaundice but there are severe forms wherein uræmia, cardiac failure, hyperpyrexia and severe hæmorrhages are apt to occur and which in some respects resemble true yellow fever. The patient may at an early stage pass into a typhoid state and the jaundice become intense while about the 8th day there is a danger of the kidneys failing which must be guarded against by free flushing, the injection of artificial serum, and dry cupping. If uræmia supervenes venesection may be required.

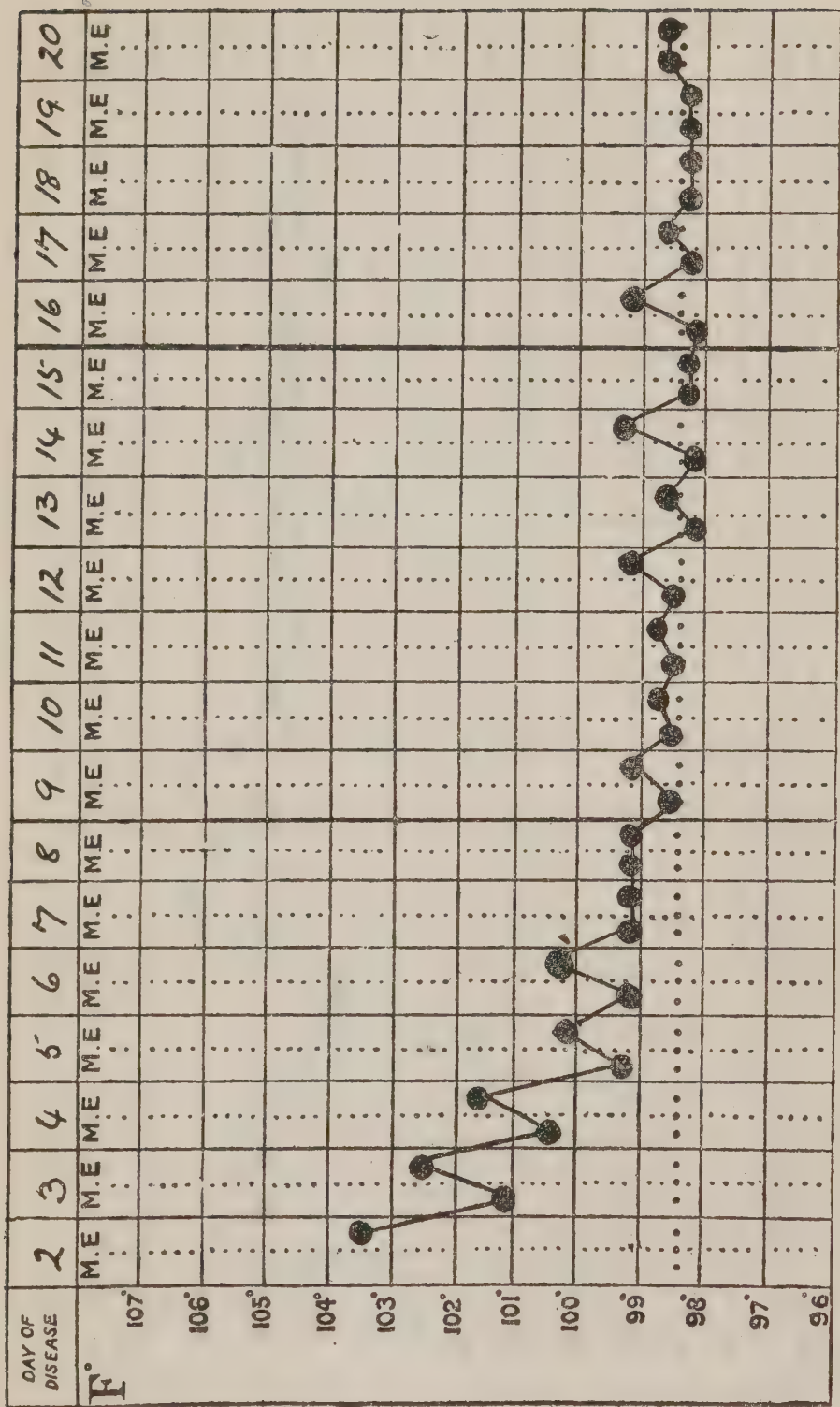
Both in Weil's disease & in the severer forms of epidemic jaundice where the functions of the liver are in abeyance glucose should be given either by the mouth or as rectal injections of 5%–10 per cent solutions. At the same time enemata of beef tea are indicated. (Hunter.)

The urine, stools & bloody sputum of patients suffering from Weil's disease must be disinfected, the sick-room for a period of 40 days as it contains spirochaetes during this period.

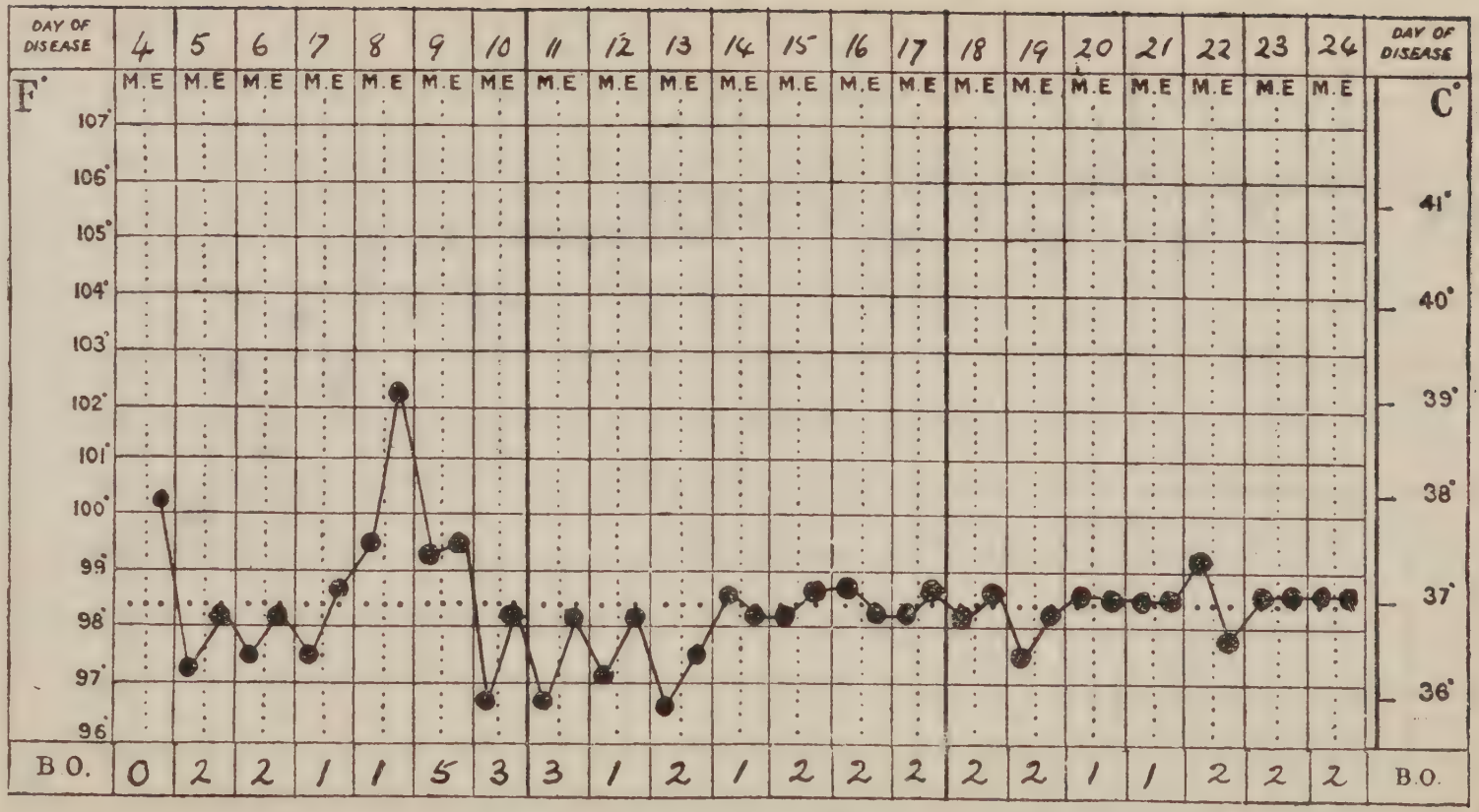


TYPE OF TEMPERATURE SEEN IN SOUTH AFRICAN CAMP JAUNDICE.

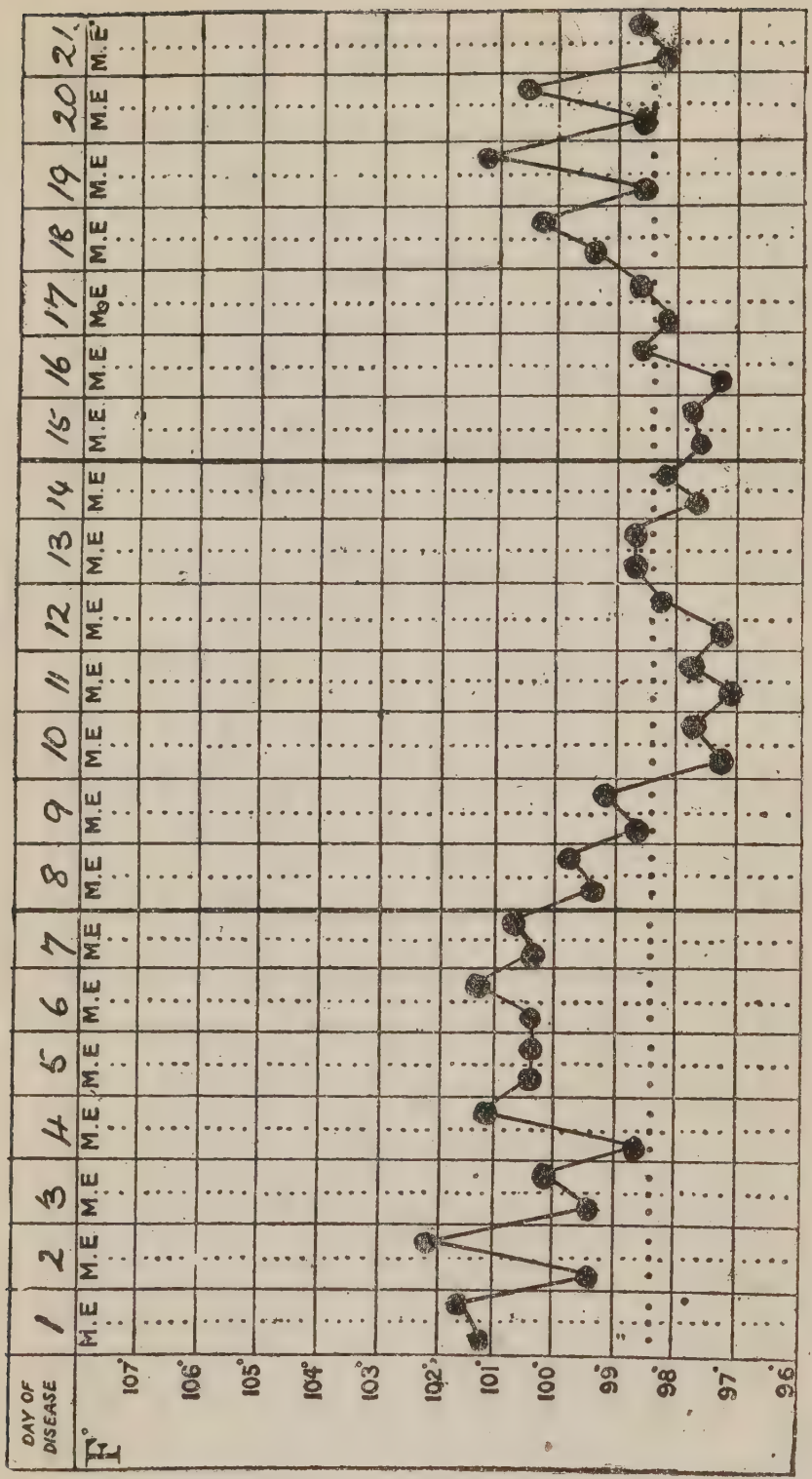




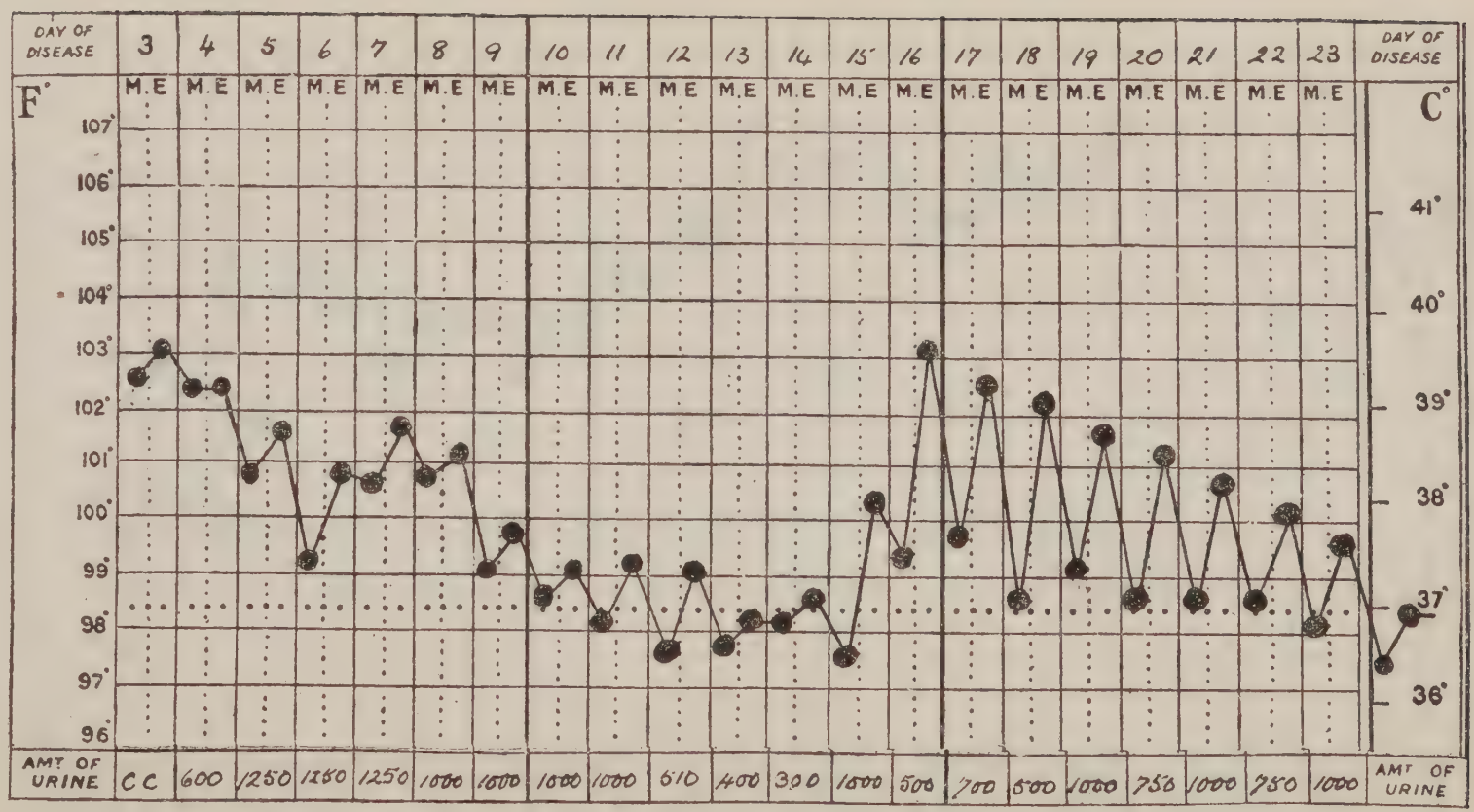
TYPE OF TEMPERATURE SEEN IN SOUTH AFRICAN CAMP JAUNDICE.



TYPE OF TEMPERATURE SEEN IN SOUTH AFRICAN CAMP JAUNDICE.



EGYPTIAN CASE OF TOXIC JAUNDICE.



EGYPTIAN CASE OF TOXIC JAUNDICE.

in certain parts of Egypt such as the Canal Zone & Kharga Oasis,

the clear-winged

The commonest Egyptian anopheline is A. (Cellia) pharoensis but the chief malaria carrier is almost certainly A. turkhudi. A. pelestinensis, A. mauritanius also occur in Egypt, along the Mediterranean coast A. maculipennis finds breeding places.

MALARIA.

A considerable number of cases of malaria, that most protean of all diseases, has occurred at Cape Helles and at Suvla Bay. Malaria is also endemic in and about Salonica, so that it is necessary to say a little about it although it is quite impossible in a short pamphlet to deal in anything like an adequate manner with what is one of the most common and important of human diseases.

Etiology.

It is known that the anophelines *Anopheles maculipennis*, *A. palestinensis* and *Cellia pharoensis* occur on the Gallipoli peninsula and the first-named at least has been definitely proved to be a carrier of infection. In Greece *A. maculipennis*, *A. bifurcatus*, and *Pyretophorus superpictus* are all responsible for spreading the disease. At Cape Helles anophelines were found in the pools formed by the drip from the cliffs. (Fig. 21.) These pools contained abundance of green algæ affording food for the larvæ and such pools are always to be looked upon with special suspicion and should be carefully examined.

The three species of malaria parasite are *Plasmodium malariæ*, *P. vivax* and *P. falciparum* and they produce respectively quartan, benign tertian and malignant or sub-tertian fever. What these terms signify and their relation to the different stages of the life-cycle of the parasite in man is indicated in Fig. 22, which must take the place of any lengthy verbal description.

It is well to remember that there occur mixed infections and also what are called subintrant infections—where one attack comes on before the other has subsided. This is due to a lack of uniformity in the developmental periodicity of the infecting parasite or to double or triple infections with the same species of parasite. These greatly alter the characteristic temperature waves shown in the diagram.

Without entering into an account of the man-mosquito cycle of the parasite, one may note that from the time the female mosquito sucks up the sexual forms from a case of malaria to the time when its salivary glands are charged with sporozoites ready for injection, say into a healthy individual, a period of 12 days usually elapses.

Symptoms.

It may be said at once that at the onset of many malarial attacks and, in the case of most sub-tertian infections, throughout the attack, an absolutely definite diagnosis cannot be made in the absence of blood examination. Malaria is so protean in its manifestations that it should be the invariable rule to make and

examine both fresh and stained blood films whenever a patient with fever may have been exposed to malarial infection or conceivably be the victim of a malarial relapse. This is tantamount to saying that every case of fever in the M.E.F. should, whenever possible, have a blood examination performed by one familiar with the malarial parasite and able to distinguish it with certainty from the manifold appearances which may, both in fresh and stained films, mimic it in any of its stages.

The incubation period varies but is roughly about a week or ten days for malignant tertian and somewhat longer in the simple tertian and quartan types. There may or may not be a premonitory stage wherein the patient feels upset, is tired, has an ache in his bones, perhaps a headache, loses his appetite, possibly vomits and suffers from chilly sensations. At this period his temperature may already have begun to rise, and later on the fever fit fastens upon him. In many cases, however, he finds himself suddenly in the grip of ague, suffering from a definite rigor and such an intense feeling of cold that his teeth chatter and he shivers and shakes.

None of the diseases dealt with elsewhere in this series have such a severe and well-marked onset as is seen in a typical ague attack. Very often the patient begins to vomit violently. He piles clothes upon himself and yet his temperature is elevated, the sensation of cold being entirely subjective. Then comes the stage of heat and febrile distress with flushed face, rapid pulse, intense headache, frequent vomiting, quick breathing and dry and burning skin, during which the temperature often runs up to 105° F. and the coverings are cast impatiently aside. There may be a slight delirium. Anon the sweating stage supervenes, the perspiration pouring from the patient and soaking everything on and about him. The fever rapidly declines and comfort takes the place of acute misery. The patient, though possibly tired, is well and can resume his duties. Then, according to the nature of the infection, one, two or three days later the fever fit recurs.

It lasts as a rule from 6 to 10 hours, say one hour for the cold stage, 3 or 4 for the hot period, and 2 to 4 for that of defervescence. The spleen enlarges during the rigor and the urine varies according to the stage and may contain albumin.

The above is a classical form of intermittent malarial fever and it has been seen, but sometimes not recognised, at Suvla Bay. On the other hand all kinds of atypical attacks may occur, especially in relapse cases and in quotidian infections, *i.e.*, when there is a daily recurrence of fever. There is no object in detailing the various forms which malarial fever may assume for they are legion, but it is well to bear in mind that *P. malariæ*, the parasite of quartan fever, has a cycle from ring form to rosette of 72 hours, *P. vivax*, the parasite of benign tertian malaria, one of 48 hours and *P. falciparum*, so-called from its crescent-like sexual forms (gametocytes), also one of 48 hours, except in its quotidian (24 hour) forms (see charts). It should also be mentioned that

sub-tertian infections tend to be more severe than the others and that the fever is apt to be of a remittent type, so that the alternation of hot, cold and sweating stages is absent. (See chart.) There are, indeed, forms of malaria known as bilious and typhoid remittent, but these are not very likely to be seen in the Mediterranean war area. The former is associated with jaundice.

The occurrence of cerebral, choleraic, dysenteric, hæmorrhagic, pneumonic and syncopal forms must not be forgotten, and as these very fatal varieties are only too often the result of lack of prompt treatment or are due to faulty treatment, the importance of early and correct diagnosis will be manifest. Moreover, if any case of malaria is neglected it may drift into a state of cachexia which it is frequently as hard to cure as it is to endure and may lead to a protracted or permanent invaliding.

Complications.

Coma, due to blocking of brain capillaries by vast numbers of parasite-laden red cells is the most important. The possibility of the occurrence of blackwater fever, known in Syria and Greece, must not be forgotten. Dysentery, if actually caused by the malarial plasmodium, is scarcely a complication, but pneumonia and nephritis merit mention.

Diagnosis.

If a typical case be seen at the onset of the cold stage, a history of possible exposure to malarial infection obtained, or indications that the patient may be suffering from a relapse forthcoming, then the pinched appearance, the teeth chattering like castanets, the successive shivers, the enlarging spleen and the elevation of temperature will, even without blood examination, make a diagnosis of malaria well-nigh certain. At any rate, if no facilities for blood examination exist, it is better to give such a case quinine than to subject the patient to the discomfort, and it may be danger, of passing through one fever fit and commencing another before coming to a definite conclusion regarding him and exhibiting the specific. Moreover, under these conditions quinine acts as a therapeutic test and by preventing any second attack may establish the diagnosis. It would, however, be well, if it were only feasible, in every case of possible malaria infection to have a blood film made and sent along with the patient to a hospital where facilities for laboratory work are provided. In many cases, even when the history suggests malaria, it is impossible to be sure without a blood examination, and, as regards the use of quinine as a therapeutic test, each case must be judged on its merits and especially has one to consider the probable nature of the infection (whether benign or malignant) and how long it will take before the patient reaches a place where the diagnosis can be clinched. In the malignant infection a marked chill is rare but the hot stage is long and severe and the tendency to delirium often apparent. When parasites cannot be found in the peripheral blood, as for example so

frequently happens after quinine has been given, a tentative diagnosis of malaria can be made if there is—

1. A clinical history of malaria.
2. An enlarged spleen.
3. A leucopenia.
4. A diminished red cell count.
5. A reduction in the hæmoglobin content.
6. An increase of large mononuclears.

Differential Diagnosis.

In this connection it is instructive to note that cases sent from the Gallipoli Peninsula and definitely diagnosed as malaria by blood examination in Alexandria were usually labelled typhoid or paratyphoid. Influenza and rheumatism were other guesses, and there figured also that refuge for the destitute—simple continued fever. All manner of diseases have been and may be mistaken for malaria, but, so far as the M.E.F. goes, the most important distinction is that between it and typhoid and paratyphoid.

How closely typhoid may resemble malaria and malaria simulate typhoid is shown in a couple of charts which explain themselves, and the milder forms may at the beginning be very like paratyphoid. Further, malaria may run concurrently with either of these infections.

Other diseases which must be borne in mind are septic conditions, and remember that malarial infection may be superimposed upon such; influenza, dengue, pneumonia, tuberculosis, hepatitis, liver abscess, relapsing fever, cerebro-spinal fever, undulant fever and so-called Mediterranean yellow fever.

Prophylaxis—Personal.

The use of a mosquito net (18 meshes to the linear inch) where feasible. The use of mosquito repellants such as oil of cassia, oil of bergamot, etc. (see section on Insect Pests). The administration of quinine, say 6-grain doses of the sulphate, bisulphate or bihydrochloride daily with a double dose once a week. If tablets or tabloids are employed they should be cracked before being swallowed. It would seem that doses under 6 grains are not always efficient. The 6 grain dose may be taken in an equal morning and evening dose or in a single evening dose.

In dealing out prophylactic quinine to soldiers it is highly important to see that it is duly swallowed. If quinine prophylaxis is adopted it must be carried out thoroughly and carefully, otherwise it is a mere waste of money, engenders a false security and leads to erroneous conclusions.

Prophylaxis—General.

For anti-mosquito measures see section on Insect Pests. Camps often abound in drainage channels and ditches, while military positions are not uncommonly traversed by small streams. For such the use of an oil drip as shown in Fig. 23 is recommended. All grass and other vegetable growth must first of all be cleared away.

In pernicious malarial attacks it is highly important to remember that abdominal pain may be a marked feature. It may be gastric, pancreatic, over the gall bladder or appendicular, thus leading unfrequently to the abdomen being opened by the surgeon. In any case of doubt, where a blood examination can be carried out, quinine should be tried as it may clear up the symptoms.

Many are of opinion that 10 grains should be given daily in very malarious localities.

While this is the usual routine, it is often all that is required; evidence is accumulating to show that better results are obtained by giving a larger quantity of quinine at the outset in the form of repeated doses. Thus a speedy & effective cure can frequently be obtained by giving six grains doses daily, continuing this treatment daily until the tenth day after the temperature has reached normal. Then reduce the dose routine as above.

Treatment.

This spells quinine, but the latter will often fail unless the liver is first of all put in good working order. Hence a preliminary dose of calomel followed by a saline is advisable. In benign infections and when the patient has not to be hurried off it is better to wait till the sweating stage begins before giving the drug. Then administer 10 grains by the mouth and thereafter 5 grains three or four times daily for a week. The later doses may with advantage be given in effervescing form, the following formula being excellent :—

I.	R/	Quinin. sulphat.	...	grs. 5
		Acid. citric. ...	...	grs. 10
		Sacchar. lact. ...	...	q. s.
		Ft. pulv.		
II.	R/	Ammon. carb.	...	grs. 3
		Potas. bicarb.	...	grs. 10
		Syrupi simplicis or Syrupi aurantii	...	℥i
		Aq. aurantii ad or Aq. ad	...	℥i

Dissolve I in II and drink during effervescence. This mixture is also valuable during convalescence for, after an attack of malaria, quinine should be taken in gradually lessening doses for a period of three months. Otherwise in many cases the infection will persist even although the peripheral blood shows no sign of parasites.

A simpler but less efficient formula is Quinin. sulph. 5 grains, dilute sulphuric acid 5 minims, syrup of oranges 1 drachm, distilled water 1 ounce.

In ordinary cases, where there is much gastric disturbance or where the drug appears to be failing to act when given by the mouth, recourse should be had to intramuscular injections. The syringe and needle must be most carefully sterilized by boiling and by rinsing thereafter with 1 in 20 carbolic acid, care being taken that not overmuch of the lotion is left behind. Paint a patch of skin in the gluteal region an inch or two below the middle of the iliac crest with tincture of iodine and inject the contents of one of the ampoules, vials or sterilettes in which sterilized quinine solutions suitable for injection are now issued, after wiping off quinine solution on the needle with a pledget of wool soaked in 1 in 20 carbolic. The full dose is 15 grains but it is perhaps better to inject half in one spot and half in the other. Be careful to avoid the line of the sciatic nerve. The deltoid is an alternative site. The application of a pad of wool soaked in 1 in 40 carbolic or a dab of collodion completes the little operation. If the solution has to be made on the spot use filtered water. Dissolve 15 grains of the bi-hydrochloride or other soluble salt in 10 c.c. of

this filtered water and bring the solution thrice to the boiling point to ensure sterility. If the solution is already made up in a bottle it can be poured into a spoon which has been lying in 1 in 20 carbolic, but before this is done the neck and mouth of the bottle should be swabbed with the carbolic solution. Then the quinine is drawn into the syringe from the spoon. With due precautions there is no danger of tetanus or septicity. The local discomfort is trifling and soon subsides and the effect is usually rapid and satisfactory.

In pernicious infections and comatose cases the intravenous route is undoubtedly that to be preferred. The dose should never exceed 10 grains of the hydrochloride or bi-hydrochloride, and the total quantity given in 24 hours should not exceed 30 grains. Five grains every four hours or 10 grains every eight hours may be injected. The strength of the solution should not be less than 1 in 300 and normal saline (0·75 per cent.) must be employed. A quantity of sodium bromide equal to that of the sodium chloride used may be added for treatment of cerebral cases.

The symptomatic treatment calls for no special notice here.

Surgeons should note that before carrying out any serious operation on a man who has or may have suffered from malaria his blood should, where possible, be examined for signs of infection, and if there is evidence of it and time admits a course of quinine given. Even when a blood examination cannot be made consider the advisability of administering quinine, for an operation often lights up a latent malaria and the disease may very seriously, and sometimes with fatal result, appear in a patient after operation.

In chronic cases exhibit iron and arsenic. A useful prescription for such cases showing splenomegaly is—

R/	Quinin. hydrochlorid	...	gr. 5 to gr. 7
	Acidi arseniosi ...	...	gr. $\frac{1}{36}$ to gr. $\frac{1}{24}$
	Pulv. ipecac. co. ...	...	gr. 3 to gr. 4
	Hydrarg subchorid	...	gr. $\frac{1}{10}$ to gr. $\frac{1}{6}$

Fiat. pulv in cachets.

Sig. One at 11 a.m. and another at bed-time.

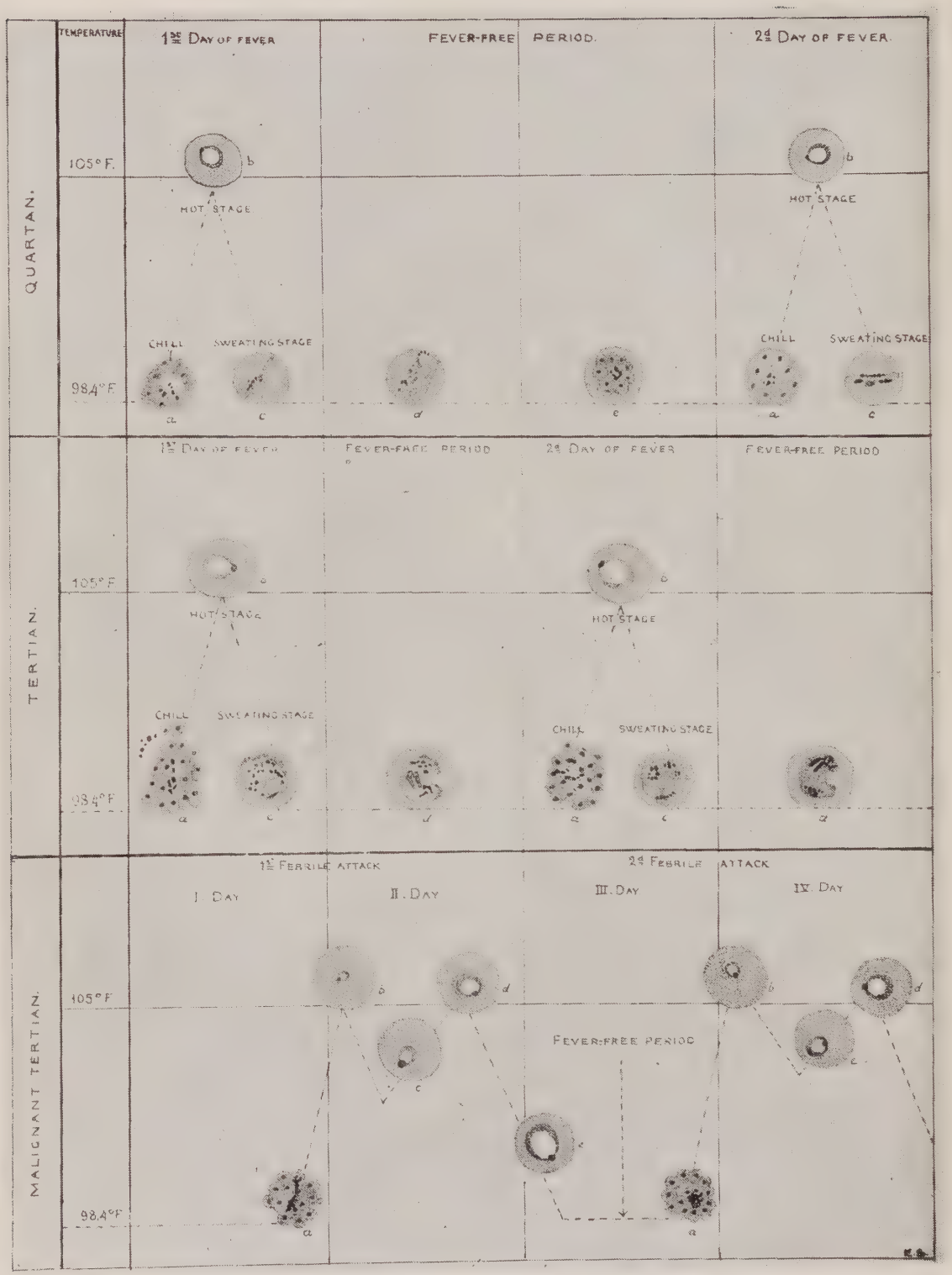
A bowl in severe cases where the liver is thrown out of action + jaundice supervenes, as in the bilious remittent type, the administration of glucose orally or by the bowel would appear to be indicated. Fruit juices or fruit juice solutions may be employed.

Fig. 21.

Pool at Cape Helles in which the larvæ of *Anopheles palestinensis* were found.

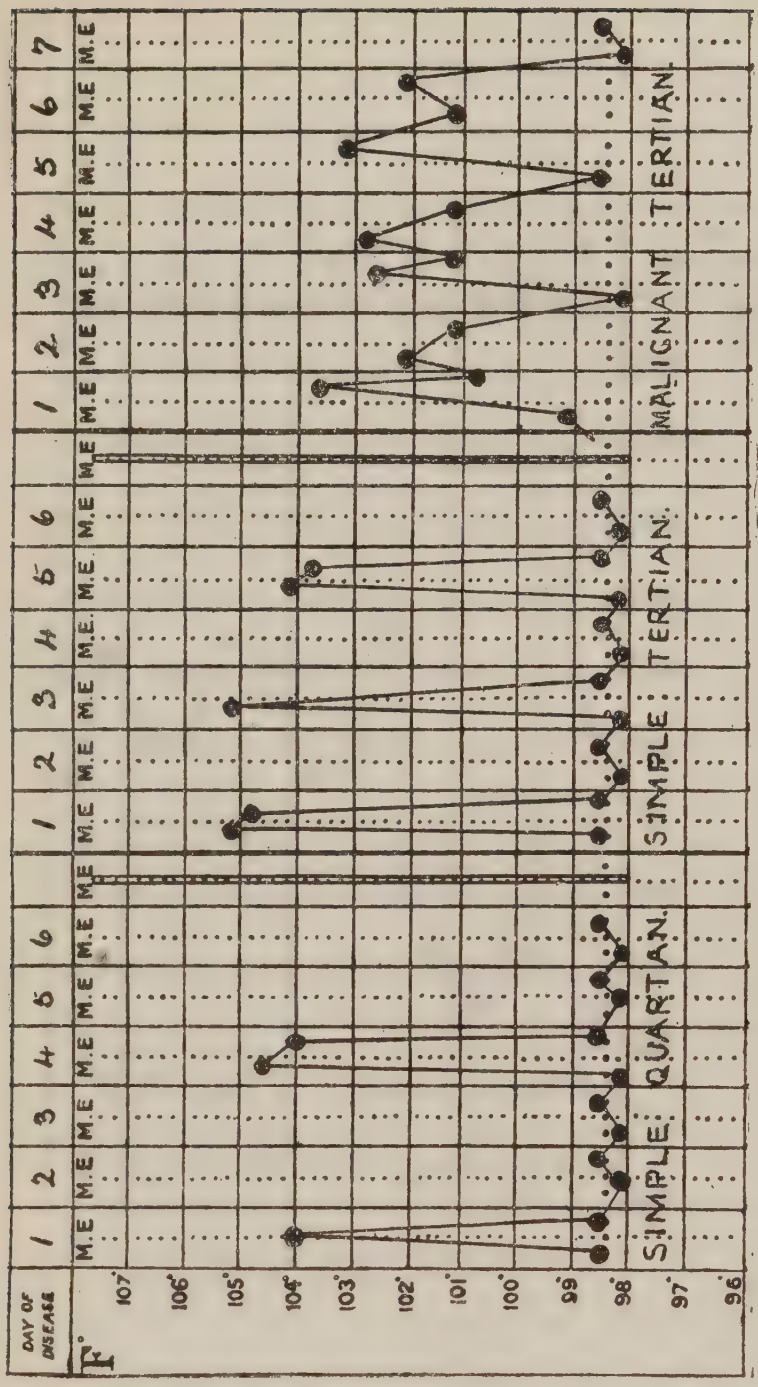
To face p. 72.]

Fig. 22.

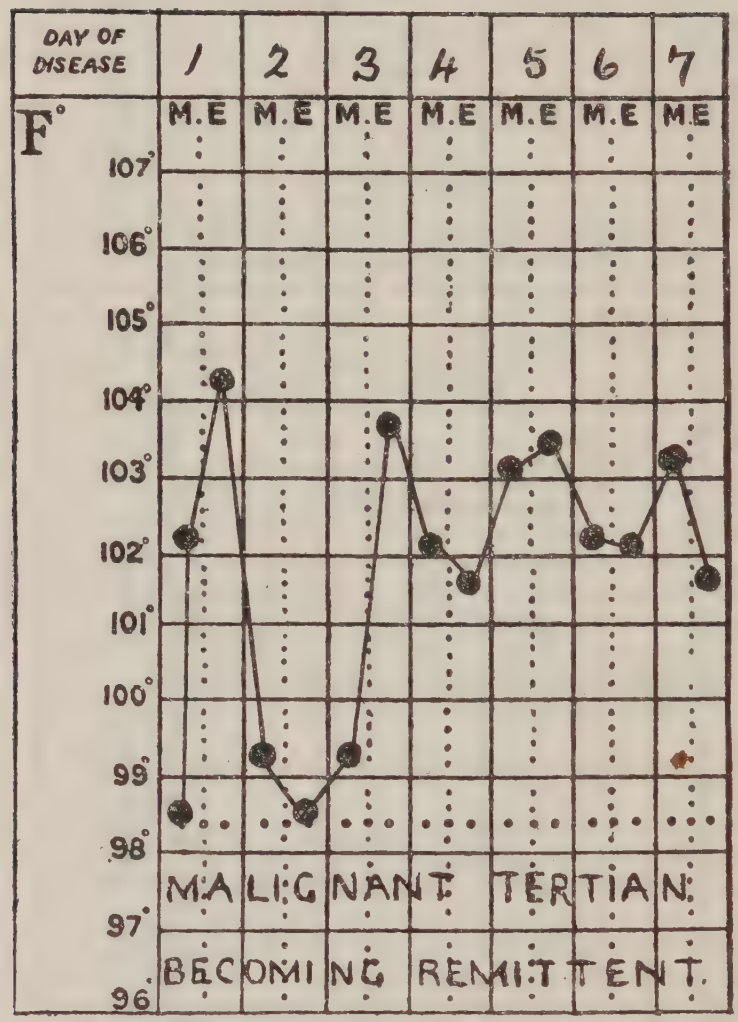


Life-cycles of malarial parasites showing correspondence between the temperature variations and the stages of development.

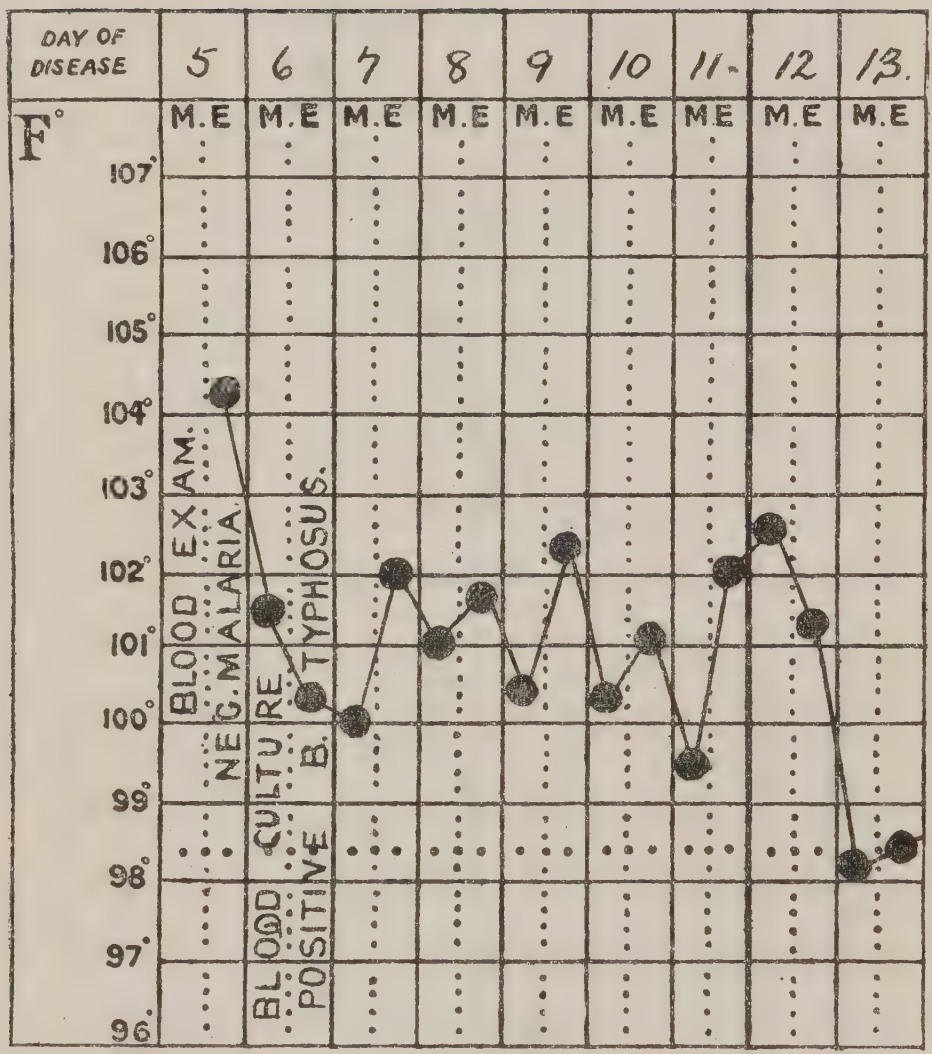
To face p. 73.]



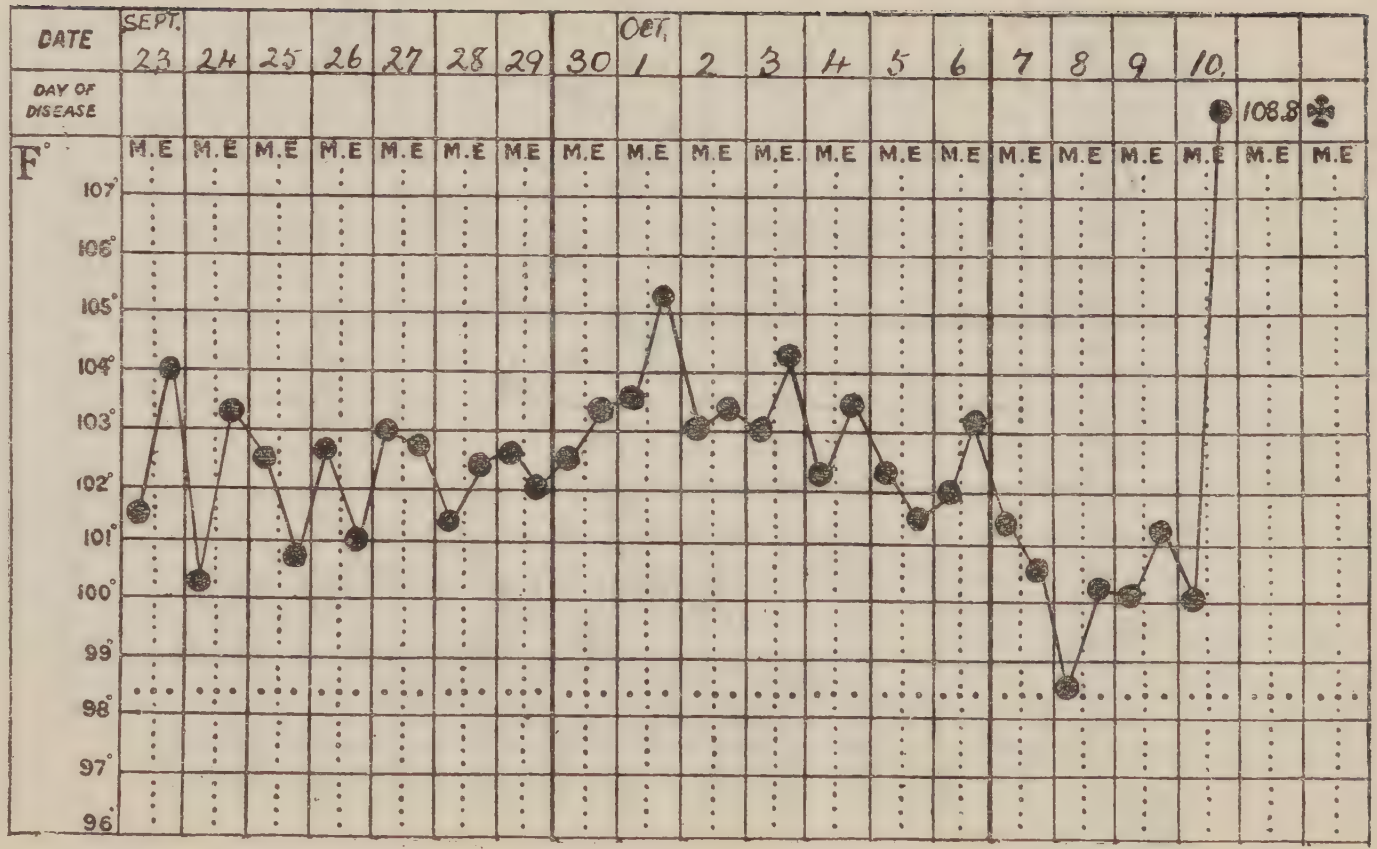
Typical Malaria Charts.



Atypical Malignant Malaria.

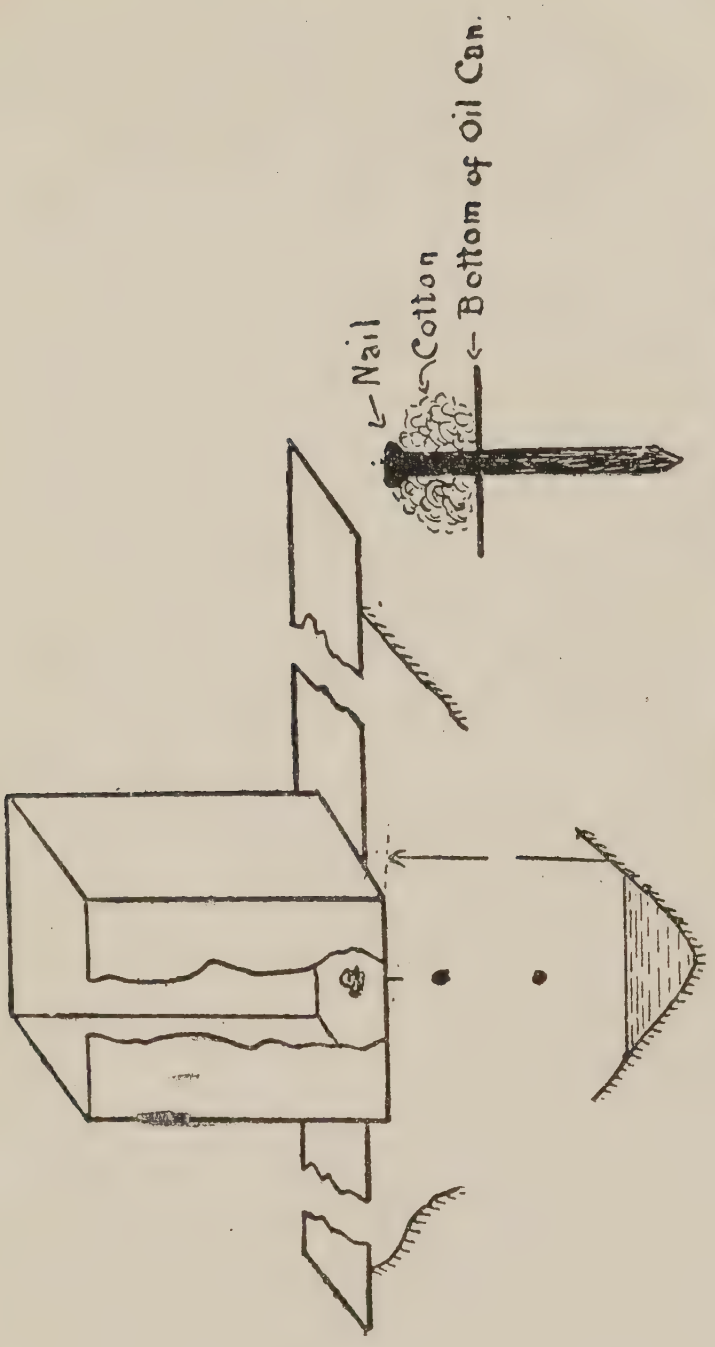


Typhoid Fever Simulating Malaria.



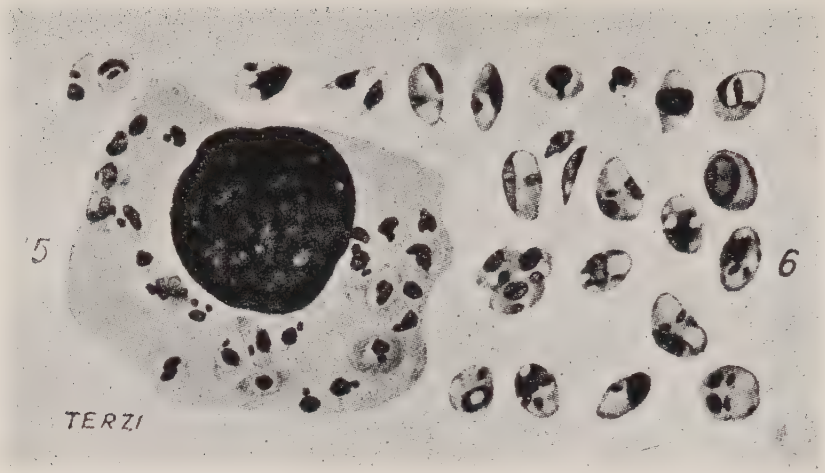
MALARIA SIMULATING TYPHOID FEVER.

Fig 23.



Oil Drip made by inserting nail in bottom of Container.

[illegible]



Leishmania tropica (*after Manson*).
5. Parasites in endothelial cell. 6. Free forms.

Oriental sore. (*After Wenyon. From photo by R. McKay.*)
To face p. 79.]

The most probable insect carrier would appear to be some species of Phlebotomus.

Oriental Sore.

This condition, better known as Cutaneous Leishmaniasis, for the lesion is not confined to oriental regions nor is it always an open sore, has occurred amongst the troops operating in Mesopotamia, and it is quite possible that cases may occur in the M.E.F., for the disease has been reported from Egypt, Arabia, Syria, Asia Minor, Turkey in Europe, and Greece. It is commonly known as Bagdad Button and Aleppo Sore.

The cause is the protozoal organism known as *Leishmania tropica* (*see* illustration). Infection is almost certainly acquired through the agency of insects, but on this matter our knowledge is still imperfect. It is possible that the disease may be acquired by personal contact with an affected case, and it is worth noting that the condition occurs in dogs. Indeed the Hippobosca of the dog has been suggested as a likely vector of the disease in Persia.

Symptoms.—The incubation period appears to vary from a fortnight to a year. The lesion may appear on any exposed part of the body but is most common upon the upper extremities, especially the forearm and hand, and on the face, especially the ear and nose. It is often multiple, being autoinoculable. It commences as a small red papule covered by a tiny reddish brown scale, and indeed suggests what might be called an indolent mosquito bite. It is less irritating than the latter and may cause no local discomfort. The papule, at first shotty to the feel, gradually enlarges, becoming purplish in colour, softer in consistence, glazed on the surface, more markedly scaled, and is surrounded by a narrow area of chronic inflammation.

After a varying period, usually 3 or 4 months, ulceration may occur, frequently as a result of an injury. The ulcer is painless and may be an inch or more in diameter. The ulceration is superficial, the whole affected area being somewhat raised and surrounded by a hard red edge in which active multiplication of the parasites takes place and in which they are most readily found, especially if puncture by a needle or a fine glass pipette is employed. The ulcer exudes a yellowish secretion, is often foul smelling and becomes covered by a tough, adherent, dark scale. If the edges of this scale are forced up the yellow pus wells out. This pus formation is probably due to secondary bacterial invasion. This may also lead to an enlargement of neighbouring lymphatic glands. Under the scab the ulceration spreads and the surrounding tissue may become œdematous.

Healing sets in after 6 to 12 months, the unhealthy yellowish granulations being replaced under the scab by healthy pink ones

and the ulcer becoming shallower. Eventually a white or pink scar is left which may be very slightly depressed and is disfiguring.

One attack confers immunity. There are no constitutional symptoms.

There is a form in which no ulceration takes place, there being merely raised, shiny, softish, moveable mounds of tissue covered by pinkish skin. Aspiration of these reveals the parasite in large numbers. These forms also proceed to resolution by a gradual shrinkage and drying.

Diagnosis.—This can only be made with certainty by the finding or cultivation of the specific parasite. The parasites may be found in pus from the ulcer surface but are more readily discovered by puncture of the unulcerated margin.

Differential Diagnosis.—In the war area cutaneous leishmaniasis must be distinguished from the so-called trench sores which, like the South African veldt sore, are due to staphylococcic infection. This can only be done with certainty by microscopic or cultural examination, but in trench sores the condition is more acute and less lasting than in the specific infection.

Treatment.—The best treatment, when feasible, is intravenous injection of tartar emetic, one per cent. solution of antimony tartrate in distilled water being used in a dose of 5 to 10 c.cs. every day or on alternate days, according to the progress of the case.

Intravenous injections of salvarsan (kharsivan) and neo-salvarsan in the usual doses have been recommended and a French method is to inject hectine (an organic arsenical preparation) in a dose of 1 cg. for each 4 kilos of body weight into the indurated periphery and base of the sore twice or thrice weekly, a fine needle being used. This is said to induce rapid healing and to lessen scarring.

Local application of tartarated antimony as an ointment in a strength of 2 per cent. has been recently used with success. Apply once or twice a day.

Another local application consists of a methylene blue ointment made up of equal parts of medicinal methylene blue, vaseline and lanoline. Apply a thick layer of the ointment night and morning for 15 days. Then wash the sore and reapply the unguent as before until healing is complete. Permanganate of potash may be employed as a 1 in 20 ointment, or better in the form of a fine powder, when it acts much more rapidly, but in this case the patient must be kept under observation. The surrounding skin is protected by a thick layer of vaseline, and the surface of the ulcer is powdered. It is then covered with a pad of gauze kept in place by a bandage. The permanganate produces sharp pain, almost intolerable, which persists for 6 to 8 hours. The slough separates in 5 to 10 days according as the sore was exuding or dry. The largest sores do not resist this treatment. At most three applications are necessary before the sore is transformed into a simple ulcer on its way to cicatrisation.

If a case is treated in this way before ulceration commences
recovery ensues without any trace of the lesion.

A combined therapy of methylene blue and permanganate may be tried. Cleanse the surface thoroughly and then dust it with powdered permanganate. At the end of 8 or 10 days remove the crust and paint the brawny elevation with 1 in 10 solution of methylene blue.

In well-equipped hospitals carbon dioxide snow may be used. It often acts admirably. Radium exposures have also been found efficacious.

Prophylaxis.—Paint the site of all fly and other insect bites with iodine as soon as possible. Warn against the danger of infection by personal contact and that of auto-infection by scratching.

PARATYPHOID FEVER.

Apart from dysentery and diarrhœa paratyphoid infections have undoubtedly accounted for most of the invalidings amongst men in the M.E.F. With the exception of troops which have served in India, B. infections have been the more common but there is no doubt that A. infections have occurred in men who had been in contact with units from India. This is in keeping with what has been observed in France. It is only comparatively recently that paratyphoid fever has been recognised as a distinct clinical entity and the following information is in the main derived from papers written as an outcome of experience in the present war.

Etiology.

Two separate and distinct bacilli are to blame, *i.e.*, *B. paratyphosus A* and *B. paratyphosus B.* They closely resemble *B. typhosus* in their morphology and general cultural characteristics but differ from it in the way they behave with specific immune sera and in certain of their cultural reactions. As in typhoid and bacillary dysentery, so in paratyphoid, the methods of infection, so far as the Mediterranean war area is concerned, may briefly and alliteratively be described as contact, carrier cases, drinking water the dust of dried dejecta and the repulsive regurgitation, dangerous droppings and filthy feet of fæcal-feeding flies.

Thanks to the universal practice of chlorination water infection does not seem to have bulked largely.

Symptoms.

The average incubation period is probably about 10 days. It is not possible to discriminate clinically between paratyphoid A and paratyphoid B. The former runs a slightly longer course and seems to be on the whole a milder disease.

The onset may be gradual like that seen in typical typhoid, but in the majority of cases it is comparatively sudden and in some it is exceedingly sharp. Headache and abdominal pain, or rather uneasiness, are the first signs as a rule and in cases with slow onset there is general malaise, diarrhœa which may pass off, slight shivering fits, pain in the back and limbs and it may be epistaxis. The patient carries on till he is no longer fit for his duties. The opposite class of case is where a patient suddenly develops abdominal pain which may be severe and colicky in type, diarrhœa and intense headache, feels feverish, shivers, may retch or vomit and is speedily prostrated.

The initial attack is indeed very like one of influenza but lacks the catarrhal element, though cough and sore-throat may develop later or may be present from the outset. Vertigo and deafness

In fact more extended observations have shown that Paratyphoid A is more common than Paratyphoid B. both in Egypt & Salonica.

Pain over the region of the gall-bladder has been noted in the earlier stages of the fever.

Intense sweating may occur, the patient being bathed in perspiration.

sometime occur and a certain proportion of patients are constipated.

The temperature rises fairly rapidly but to no great height, somewhere between 100° and 101° F.

There would seem to be very slight cases of the disease where the patient is only really ill for about a week, but a typical para B attack runs a course of anything between 10 and 18 days and a characteristic para A exhibits a 3 weeks' pyrexia.

Even at the height of his illness the average paratyphoid case does not look seriously ill. The general temperature course is indicated in the accompanying charts and only a small number of cases exhibit anything approaching a true typhoid state. In all, however, especially in the early stages, there is a certain lethargy or apathy. A flushed face is rare and the eyes are dull and often kept about half closed owing to the headache which is the patient's chief complaint.

The spikey nature of the temperature will be apparent and is very characteristic. It rarely falls to 99° and as rarely rises to 103°. In most cases it keeps swinging between a couple of degrees, up at night and down in the morning but occasionally missing the remission. Now and then one meets with a case showing intermission. Of all symptoms the pulse rate is probably the most important for, unless the patient has been smoking, it is nearly always slow and very often slower, as compared with the temperature, than it would be in true typhoid. Thus a pulse rate of 60 may coexist with a temperature of 100° or 101° F. It varies, however, and several have noted a low rate coinciding with a high temperature. Other notable features are a certain compressibility and dicrotism.

The tongue is dry and as a rule rather characteristically furred, there being a red tip, red edges and central red channel with two separate patches of thick white or yellowish white fur. In bad cases the regular dry, brown, furred, cracked tongue of typhoid is in evidence. There is little in the way of abdominal symptoms save a certain elasticity of the abdominal wall, and the spleen is not often palpable. There may be tenderness in the left hypochondrium and percussion not infrequently indicates splenomegaly. The liver is not enlarged, nor, save in paratyphoid A infections, is the gall bladder painful in uncomplicated cases.

Rose spots are very commonly seen. They come out in crops at intervals of 3 to 7 days, probably as a rule between the seventh and tenth day and last for 3 or 4 days. In a good many cases they are only present after the temperature has fallen to normal. As many mild cases from Gallipoli do not reach Alexandria or Malta until defervescence has set in it is well in every case with a febrile history carefully to examine for this eruption. When fully developed the spots are distinctly larger, redder and more lenticular than those of true typhoid. Sometimes they remain of the typhoid type. Their favourite sites are the lower ribs in front, the flanks and the back of the shoulders. When profuse they are scattered over the abdomen and may be minutely vesicular or have

an acne-like appearance. In number they may vary from half-a-dozen to well over a hundred. It is said that in paratyphoid A infections the rash tends to be very profuse and may somewhat simulate that of measles.

Some bronchial catarrh is often present but severe bronchitis is not common.

It is to be noted that moderately severe cases often markedly improve a few days after admission to hospital and this quite apart from any treatment beyond dieting and nursing. The usual fall of the temperature by modified crisis or short lysis is shown in the charts. Relapses are not uncommon and this is specially true of paratyphoid A where they may be associated with rigors. There are slight and more severe forms. The latter are more or less recrudescences of the disease. Actual re-infections are rare.

Prognosis.

This is good except in cases showing meteorism, severe bronchitis, certain other complications or, and this is important, a persistently rapid pulse, *i.e.*, above 100. At the same time it is well to remember that there are very severe and fatal forms of both types of infection.

Complications.

Jaundice may mask a paratyphoid infection and should always be regarded with suspicion. A considerable number of complications are mentioned, the more important being hæmorrhage, perforation and femoral thrombosis. The tendency for paratyphoid B infections to involve the large bowel and to be associated with abscess formation must not be forgotten. A case complicated by cerebral abscess has recently been recorded. Tachycardia may be troublesome during convalescence.

Diagnosis.

The bacteriological diagnosis is of great importance. Blood culture as a rule is only positive at the beginning of the disease. Even at this stage negative results are common. The value of the agglutination reaction in paratyphoid has certainly not been enhanced by anti-typhoid inoculation but this is a matter which cannot be here considered. A leucocyte count will show leucopenia. Half-a-dozen negative examinations of the stools must be made before paratyphoid infection can be excluded and even then the bacillus may be missed. It is rarely found in the urine.

Differential Diagnosis.

In the Mediterranean war area apart from true typhoid the disease which seems most often to have been mistaken for paratyphoid is dysentery. There is not much excuse for such a mistake and if medical officers were more careful to view the stools of their cases this error would not so frequently occur. Other faulty diagnoses which have been noted are jaundice, influenza, especially gastric influenza, bronchitis, rheumatism and appendicitis. The

as does infection with B. faecalis alkaligenis.

Murphy's method of administering drop by drop per rectum a 6 per cent cold solution of glucose has been highly recommended as an anti-thermic measure which has an excellent effect on the patient's general condition. (Jacques Charles).
Thirty to forty drops are given per minute, so much as three quarts may be administered in the 24 hours. A single injection may be given in an hour to an hour and a quarter.

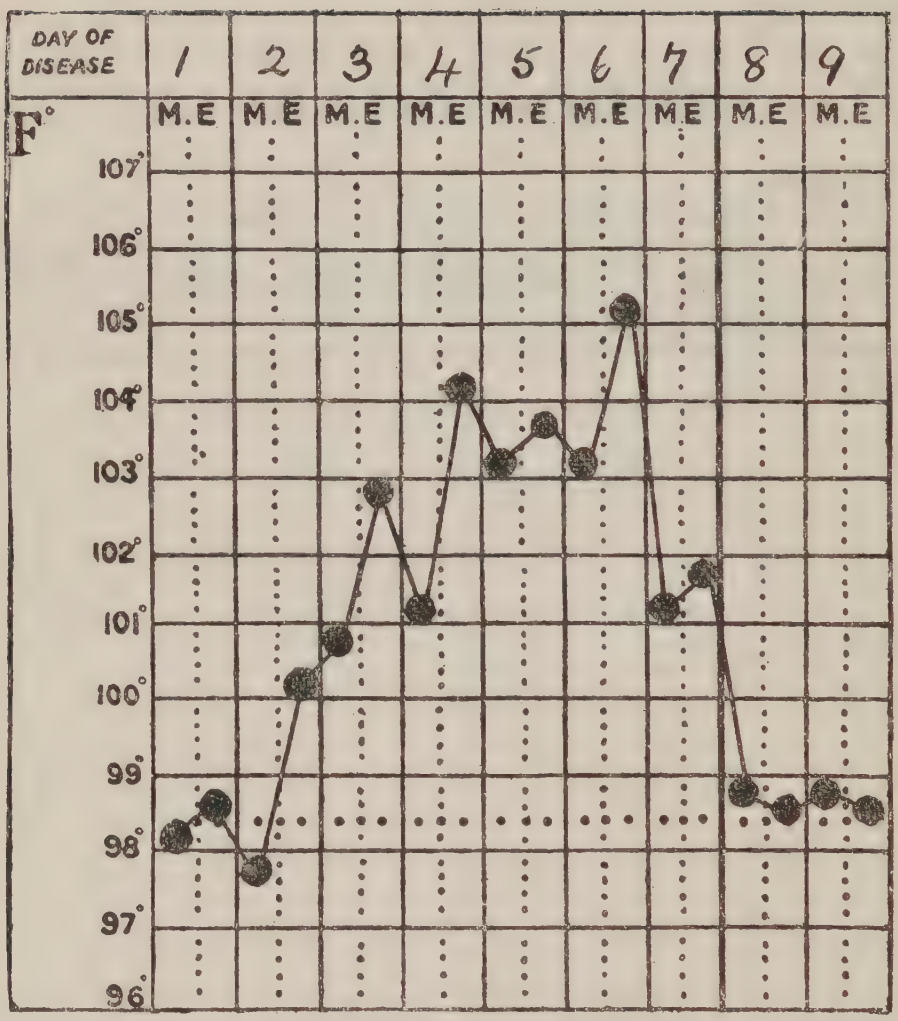
condition is liable at its outset to be confused with phlebotomus and dengue fever and with malaria by those unfamiliar with these diseases. B. coli septicæmia may simulate it and can only be diagnosed definitely after bacteriological examination while a so-called infective gastro-enteritis, possibly due to *B. coli communis* and in which the whole dorsum of the tongue is furred may closely resemble paratyphoid.

Prophylaxis.

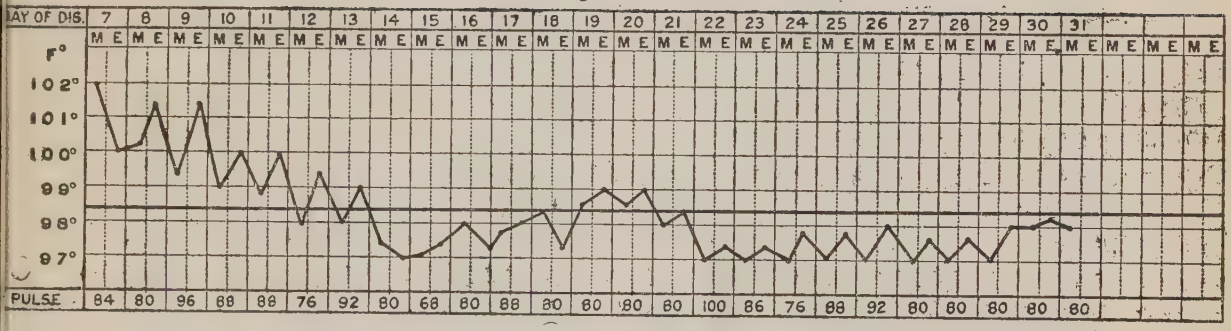
As for bacillary dysentery. (*See* section on Dysentery.) General anti-paratyphoid inoculation is now being carried out. Anti-typhoid vaccination affords little, if any, protection.

Treatment.

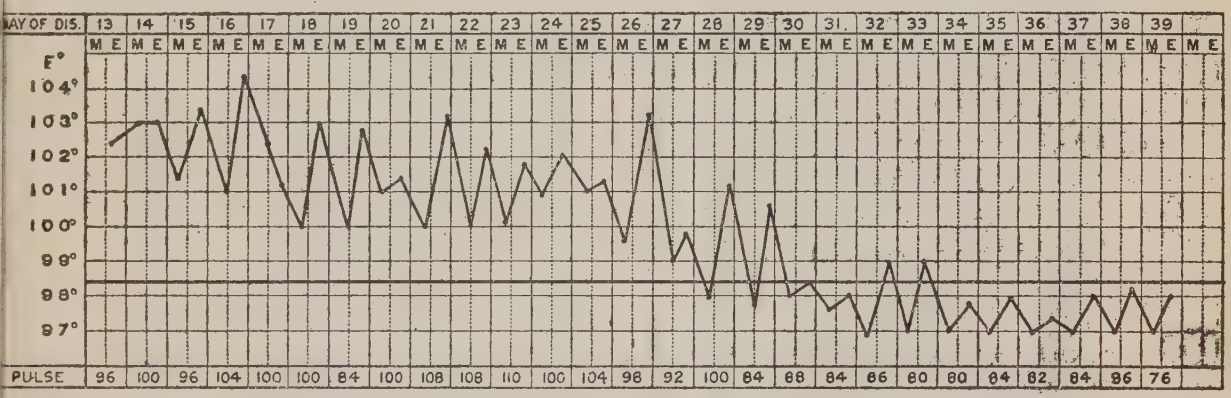
As for typhoid fever. Enemata are indicated in the earlier stages. Aspirin often relieves headache and hypnotics are sometimes required. A liquid dietary is necessary during the fever. Three days after the temperature reaches normal jelly may be given and thereafter custard, porridge, etc. until the stage of solid food is reached.



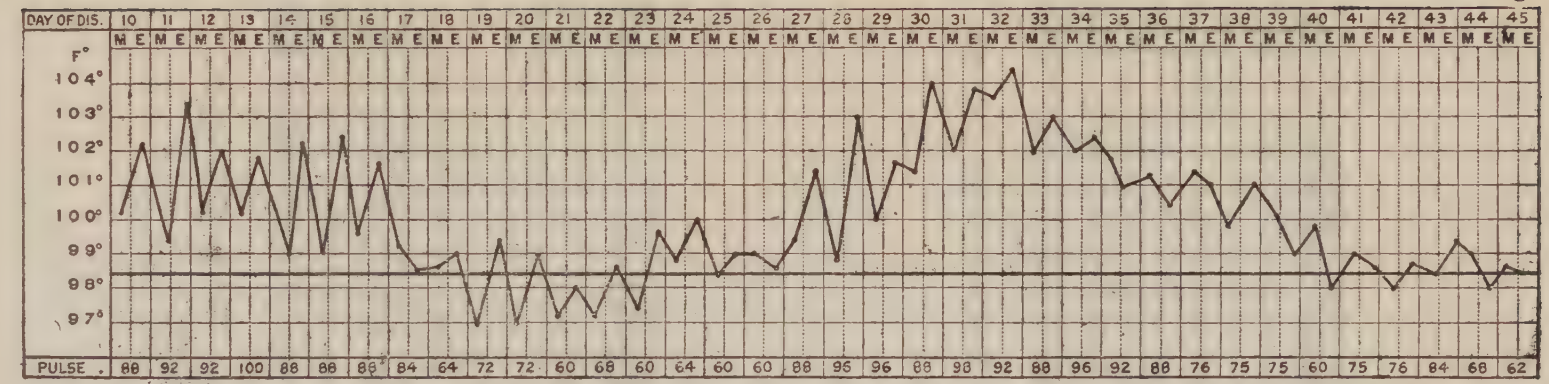
Short attack Paratyphoid. Gradual onset and rapid defervescence.



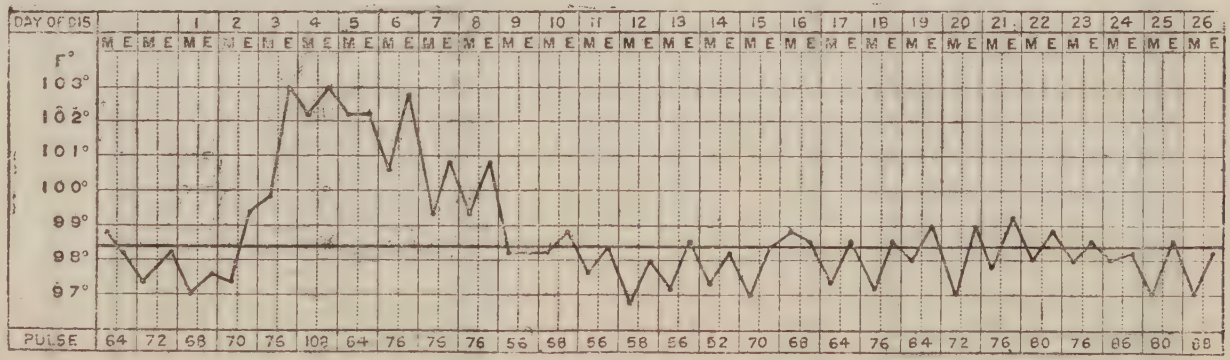
Typical mild short Paratyphoid A. Thirteen days' pyrexia.



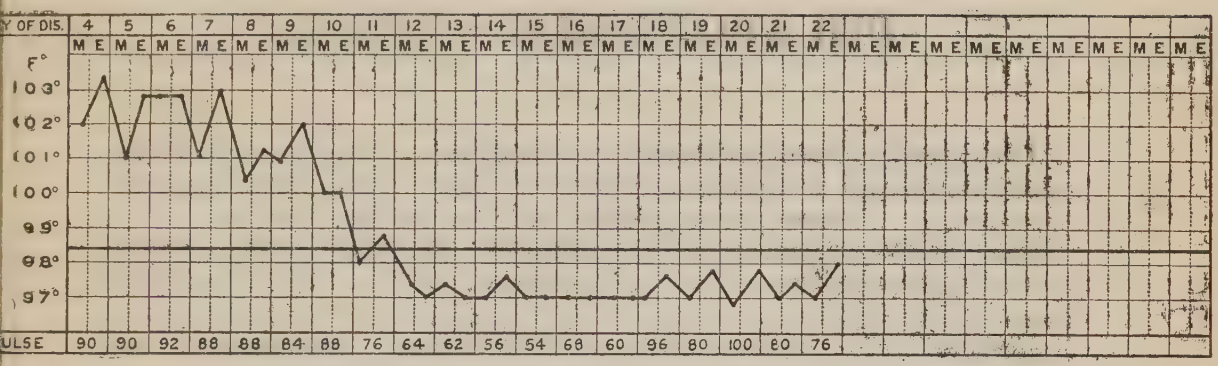
Paratyphoid A, mild but prolonged. Thirty days' fever.



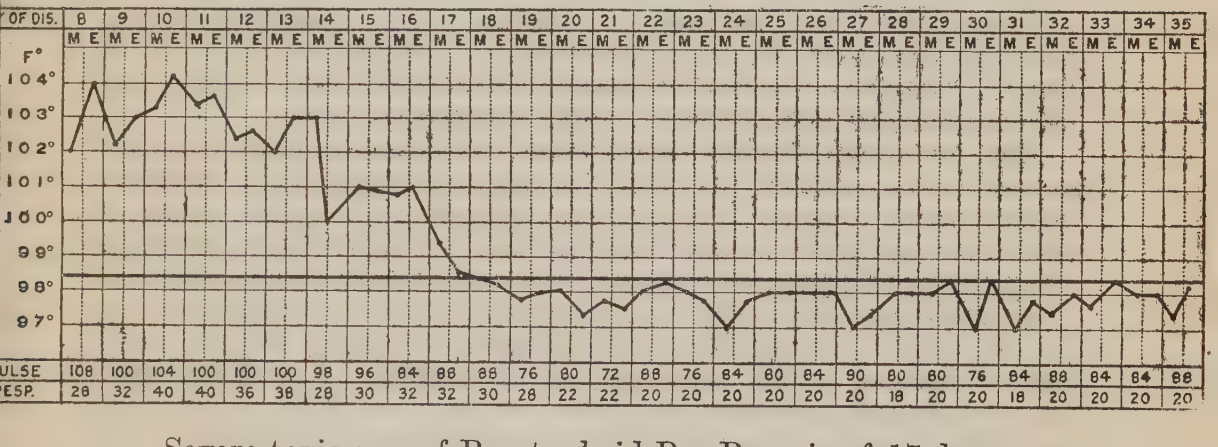
Rather severe Paratyphoid A. Pyrexia of average duration and relapse.



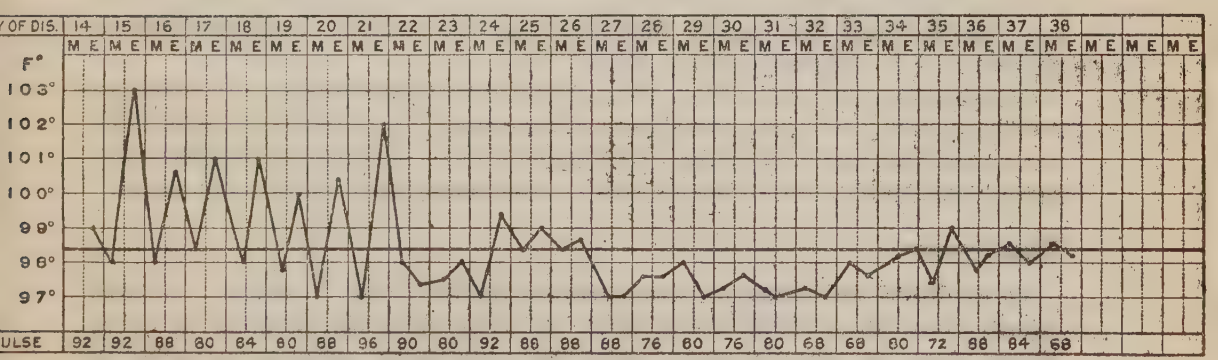
Typical short Paratyphoid B. Rapid rise and quick fall on 9th day.



Typical rather severe Paratyphoid B. Eleven days' pyrexia.



Severe toxic case of Paratyphoid B. Pyrexia of 17 days.



Mild case of Paratyphoid B with intermittent temperature.

PHLEBOTOMUS FEVER.

This specific fever of short duration has a wide geographical distribution and is known to occur in Egypt and on the Gallipoli Peninsula. It ~~has~~ specially affected the French troops at Cape Helles. The infective agent is unknown, being probably an ultra-microscopic organism which is introduced by the bite of a minute insect, hairy as Esau, and popularly, though erroneously, known as a sandfly; hence the synonym Sandfly Fever. Pappataci Fever and Three Days' Fever are other terms for the disease.

The Fly.

The fly itself, of which several species are known, all probably capable of conveying infection, is really a midge and is exceedingly minute, its tiny, hairy body minus its legs and wings being about a quarter the size of the head of an ordinary pin. Including wings and legs the insect occupies an area about equal to the size of a pin's head. (Fig. 24.) As the fly passes the winter in its larval stage phlebotomus fever is a disease of the summer months.

The breeding places of the fly are the interior of rubble and stone walls, crevices of caves, cracks and fissures in artificial embankments such as the earthen parapets of trenches, walls of old cellars as in the case of Sedd-el-Bahr at Cape Helles, amongst heaps of damp stones, bricks and tiles, and also in the surface soil. A certain amount of moisture is essential for the development of the larvae. The adult flies shelter in similar situations, in clods of earth, beds of streams and in holes in trees. It is worthy of note that they may be carried in timber and other cargo from place to place by sea-going vessels, a matter of some importance in districts where hospital huts, cooking sheds, wooden latrines, etc., are being erected.

Towards evening the flies sally forth upon the blood quest, the females alone being bloodsuckers. They chiefly attack the wrists and ankles and can easily bite through thin socks or light cotton clothing. A single fly can infect.

At sunrise they vanish, either retiring to their breeding haunts or seeking dark corners in rooms or dug-outs. They dislike sunlight but are attracted by lamps and candles. It is probable that they rarely traverse more than 50 yards or so and they do not fly high.

The Fever.

It is short and sharp. Incubation period 4 to 7 days. Attack usually sudden, commencing with a feeling of chilliness and malaise. There may be rigors but these are never so severe as those of malaria. Vertigo, very severe frontal headache, pain at the back of the eyes, accentuated by pressure on the globes and the least

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movement of the head, pains in the back and legs like those of influenza and general stiffness of the muscles soon prostrate the patient who becomes drowsy, irritable if roused but suffers from insomnia. The face is very flushed and may look swollen. The conjunctivæ are injected so that the appearance resembles that sometimes seen in mastiffs or bloodhounds, hence the original name of "dog disease." There is no lachrymation or catarrh as are commonly present in influenza. Anorexia with pain or discomfort in the pit of the stomach is a feature and constipation is the rule though diarrhœa sometimes occurs, as does vomiting. The tongue, clean at the tip and edges, is coated elsewhere by a thin, white fur. The fauces and palate are often congested and may exhibit small vescicles for which it is always well to look. Epistaxis is not infrequent at a late stage of the illness. The skin is generally dry and even harsh but may be moist. Apart from the face flush which may involve the neck and upper part of the chest there are no rashes but these may be simulated by the numerous bites of the sandflies which, possibly as the result of scratching and irritation, may assume the appearance of a severe lesion, even simulating the exanthem of chicken pox. Typical temperature records are shown. The rise is rapid. By the evening of the first day's fever a temperature of 101° to 103° is reached. It remains elevated for about 24 hours and then begins to fall, descending gradually on the third and fourth days and thus terminating very differently from the crisis of an ague fit. It is very rare to find an after rise of temperature. The pulse rate throughout is comparatively slow and the blood picture is rather typical, *i.e.*, a leucopenia with a relative decrease in the polymorphs. The eosinophiles diminish during the fever but increase after it.

The patient may get better rapidly or convalescence may be protracted and characterised by mental depression, lethargy, dyspepsia and insomnia. Recovery appears to be the invariable rule. The blood is only infectious during the first 24 hours of the illness and the infected sandfly only becomes capable of transmitting infection after the lapse of six days.

At the present time the disease which most closely simulates this fever is paratyphoid, especially in its early stages and milder forms, but abortive enteric, dengue, malaria, undulant fever and influenza may be mistaken for it. In dengue rashes are present in 70 per cent. of the patients ; in influenza respiratory catarrh is a marked feature.

Prevention and Treatment.

Under war conditions it is rarely if ever feasible to make use of fine mesh muslin as a measure of protection, to trap the adult flies or to deal with breeding places. Fumigation with sulphur might, however, be tried in the case of rooms and dug-outs. All that can usually be done is to employ repellants. Of these the most useful is probably oil of eucalyptus which should be rubbed over the parts apt to be bitten, more especially the wrists and ankles, and

sprinkled on the bedding. Howlett strongly recommends oil of cassia. A lump of camphor may also be taken to bed as the flies dislike its odour.

The following prescription is useful :–

R/ Ol. anisi, Ol. eucalypti, Ol. terebinth. aa m. ... m.
Lanolini ℥ i
M. ft. ung.

The most valuable drug in the treatment of sandfly fever is opium, especially if given early. A full dose (30 drops) of Extractum opii liquidum (Liquor opii sedativus) administered at the outset will be found to give great relief. Failing this Tinct. opii may be given, also in a full dose.

Quinine is useless and may aggravate the symptoms. Aspirin and the salicylates in fairly large doses often afford comfort and pyramidon has also been found to assuage pain.

Cases treated in endemic areas in hospital should be surrounded by fine mesh nets to prevent the risk of others becoming infected.

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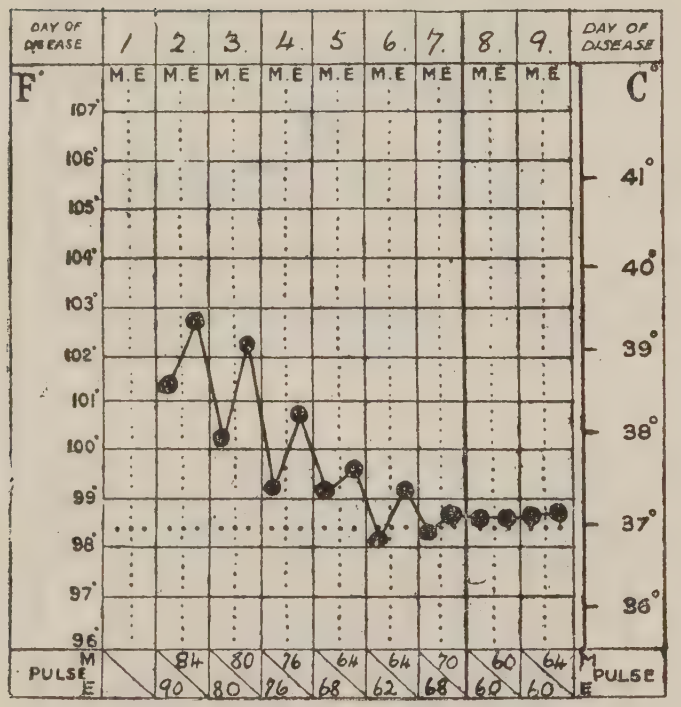
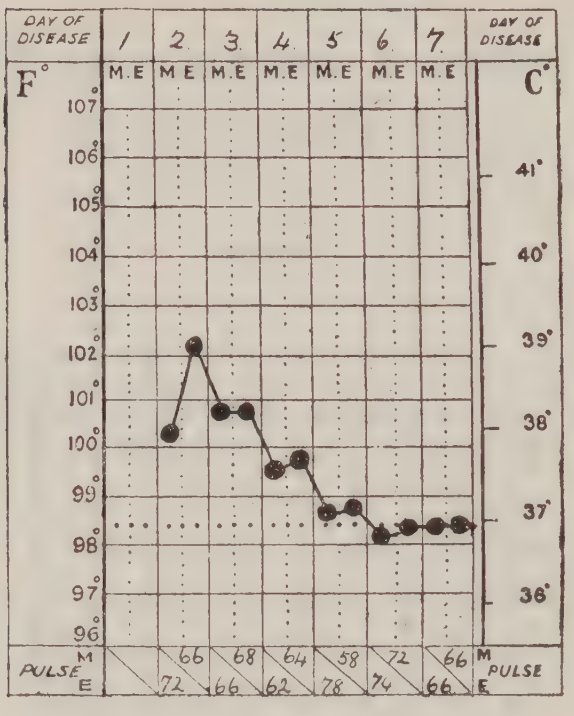
TYPE OF TEMPERATURE IN PHLEBOTOMUS FEVER.



VARYING TYPES OF TEMPERATURE IN PHLEBOTOMUS FEVER.



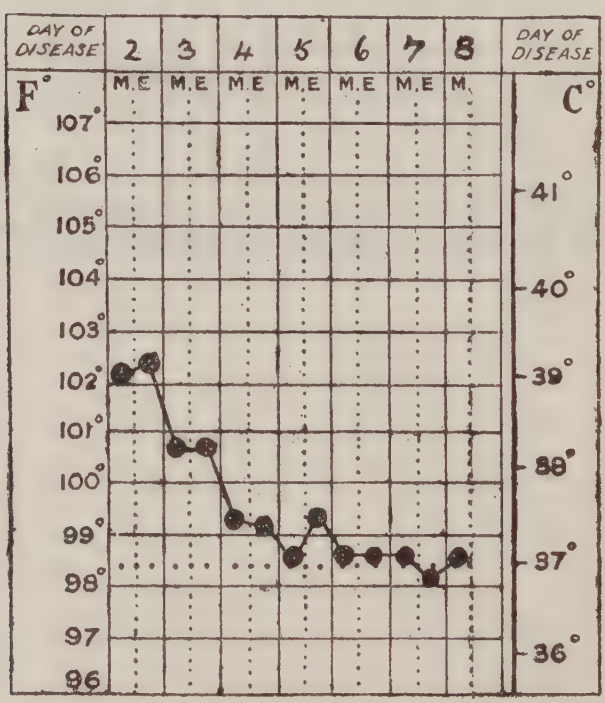


Fig. 24.

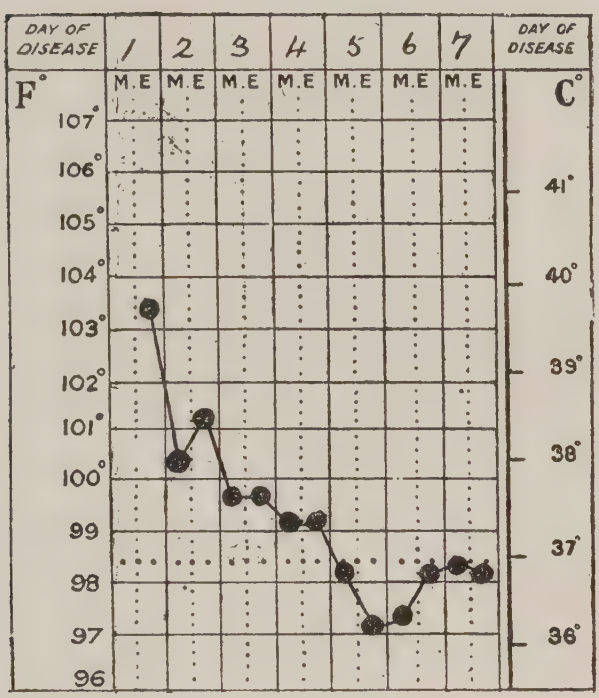
PHLEBOTOMUS PAPATASII.

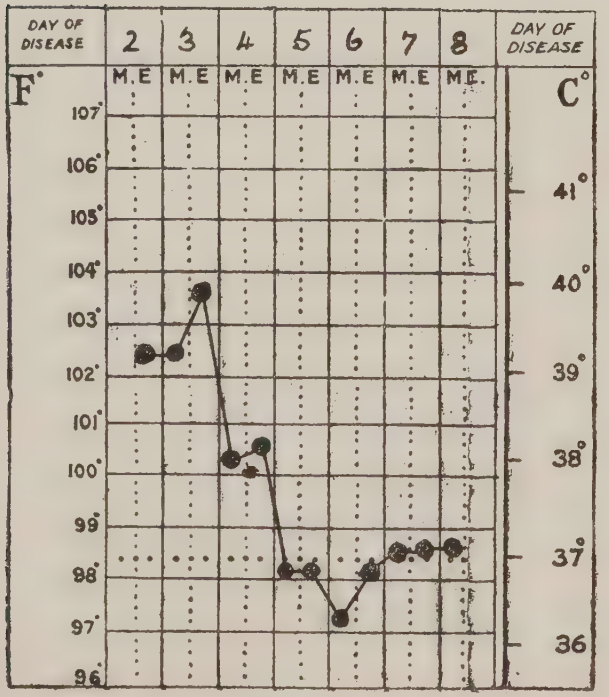
9. Natural size.

10. Fly greatly enlarged.
    a. Antennae.
    b. Palps.
    c. Proboscis (biting part).
    d. Head.
    e. Prothorax.
    f. Plates of mesothorax.
    g. Halteres (balancers).

To follow p. 95.]

VARYING TYPES OF TEMPERATURE IN PHLEBOTOMUS FEVER.





PLAGUE.

With the aggregation of ships in Eastern Mediterranean ports, the movement of Turkish and Russian troops from East to West, and the proximity of Egypt, plague may yet make its appearance in the war area, and hence a few notes regarding it do not seem out of place.

Etiology.—The disease is primarily an epizootic in rats and other rodents, is due to the coccal-like, bipolar staining, Gram-negative Bacillus pestis, and in its bubonic form is conveyed from rat to man by the rat flea, *Xenopsylla cheopis* (Fig. 25). Both the grey rat, *Mus norvegicus*, and the black rat, *Mus rattus*, fall victims. The former is the usual ship rat, and in both species plague occurs as an acute and chronic infection. The black rat is the more dangerous, as it lives in closer association with man.

There is some evidence to show that bed bugs may be operative in spreading bubonic plague, but their rôle is certainly a minor one.

Pneumonic plague is transmitted from the sick to the healthy by droplets of sputum expelled in coughing, and also apparently by the invisible spray which pneumonia patients discharge from the mouth. It is worth noting that the domestic animals, in times of epidemic, may suffer from pneumonic plague and become sources of infection.

Virulent plague bacilli were isolated from the lungs of donkeys in North Manchuria.

Both bubonic and pneumonic plague may become septicæmic in type, but the disease may be septicæmic from the outset. There is some evidence to show that, in the case of primary septicæmic plague, infection may take place through the gastro-intestinal tract.

There are thus three recognised forms of plague and of infection.

It might be supposed that the flea inoculates the bacillus when it bites. This is not the case. What really happens is very interesting. The flea sucks up blood containing plague bacilli. These multiply at its proventriculus, and the bacillary mass eventually extends into the œsophagus, thus blocking the entrance of the stomach. The starved flea makes violent efforts to get more blood, and the œsophageal contents regurgitate, thereby infecting through the skin lesion the healthy person on

whom the flea is trying to feed. The flea itself does not necessarily die from the obstruction, but it is apt to do so if the weather is dry, presumably from lack of fluid.

Infection may also occur from the bacillus-containing fæces of the flea voided on the skin and rubbed into the wound.

When rats become ill or die, the fleas leave them and attack man. This is specially true when the epidemic is amongst black rats.

Symptoms.—The incubation period is from 2 to 8 days. Rarely it may be extended to 15 days, but a quarantine of 10 days is usually considered sufficient. Prodromata are rare.

There is an ambulatory form, or Pestis minor, in which the fever and prostration are slight. There may be some swelling and tenderness of the lymphatic glands, and there is usually at the site of the flea-bite the primary vesicle or pustule. It is very important to search for this and have it examined bacteriologically. Patients with Pestis minor may suddenly collapse. They are dangerous, for they act as carrier cases.

All three forms of Pestis major present certain symptoms in common, *i.e.*, sudden onset, sharp fever, vertigo, great prostration, a drunken gait, appearance and speech, and great cardiac weakness.

Bubonic Plague.—The patient suffers from headache and drowsiness and his face is pale and anxious. His features become drawn and haggard, his eyes bloodshot, sunken and staring, his expression often one of fear or horror. If still able to walk he drags himself along like one in a maze or staggers about like a drunken person. As the fever increases his face gets hot, flushed, and bloated and his pupils dilate. The fever curve, as seen by the chart, is irregular and the pulse is rapid and weak. Thirst is intense, the furred tongue becoming dry and brown and sordes accumulating about the teeth, lips, and nostrils. Delirium, and even convulsions, may ensue. The spleen and liver are enlarged, the urine scanty, but rarely definitely albuminous.

About the second or third day the chaarcteristic bubo or buboes develop. The bubo is most commonly inguinal, but the axillary, submaxillary, cervical, or other glands may be involved. As a rule, there is only one bubo, which varies from about the size of a walnut to that of a goose's egg. The œdema of the surrounding tissue makes it look larger than it really is. Pain varies, but may be very severe. In cases which are going to recover improvement sets in about the fourth or fifth day and is signalised by a profuse perspiration. The bubo continues to enlarge and soften, and, if not incised, bursts and discharges pus and sloughs. From the sixth to the tenth day the temperature becomes normal and the patient convalescent.

Epidemics vary in their symptoms. In some, hæmorrhages, which may be petechiæ or large purpuric spots or definite bleedings from the nose, stomach, intestines, &c., occur; in others, gangrenous areas of skin occur over and about the suppurating buboes; in others, pulmonary congestion and inflammation are present. When the case ends fatally death usually takes place between the third and fifth days.

Pneumonic Plague.—Rigors and vomiting often characterise the onset. Cough, dyspnœa, and cyanosis occur, accompanied by a profuse, watery, blood-tinged sputum, which is quite unlike the rusty, tenacious sputum of ordinary lobar pneumonia. This plague sputum teems with bacilli and is exceedingly dangerous. The patient never has a chance. Moist râles are heard over the bases of the lungs, the toxæmia is intense, the breathing rapid, and death speedily ensues. The type of temperature is shown in the chart.

Septicæmic Plague.—In the primary form the patient is at once rendered prostrate. His pulse speedily becomes thready or imperceptible at the wrist, he is pale and apathetic, and his temperature, owing to the magnitude of the infection, may scarcely rise at all. Hæmorrhages often occur and stupor, coma, or delirium herald speedy death. There have been cases where intense headache and fever were the only signs and where patients died within 48 hours.

Morbid Anatomy.—All that need here be mentioned is the marked involvement of the lymphatic system and the destructive action of the plague toxin on the endothelial lining of blood-vessels and lymphatics.

Differential Diagnosis.—The disease most like plague in its early stages is typhus fever. In both there is the same mental hebetude and drunken aspect, but the course of the illness and the bacteriological examination soon clear up the difficulty. A venereal bubo may be mistaken for a plague bubo, a fulminant case of enteric for early bubonic plague, and an influenzal pneumonia for pneumonic plague.

An ordinary septicæmia, some varieties of relapsing fever and a pernicious type of malaria may simulate septicæmic plague. It is worthy of note that mixed cases of plague and relapsing fever are not uncommon.

Prophylaxis—Personal.—So far as bubonic plague is concerned this consists in warding off the attacks of fleas and bed-bugs. Pesterine is a good pulicide, and consists of kerosene 20 parts, soft soap 1 part, and water 5 parts. Dissolve the soap in the water and gradually stir the oil into the hot mixture. Fleas dislike the smell of iodoform, but so do most people, and

the free use of iodoform powder would probably lead to an undesired isolation. Naphthalene alone or naphthalene in kerosene may be tried. Tricresol powder (3 per cent. cresol powder) has been strongly recommended.

Attendants on plague patients should wear leather or rubber gloves, overalls, and be protected about the feet and ankles by means of puttees or gum boots. No food or drink should be partaken of in plague wards, and hand disinfection is essential.

For other measures as regards both fleas and bed-bugs see section on Insect Pests.

There are various plague vaccines, the best known being that of Haffkine, which consists of the killed bacilli and the chemical products of their growth in broth. The Yersin anti-plague serum may also be used for prophylaxis.

Those in contact with cases of pneumonic plague must wear masks, goggles, and overalls.

Prophylaxis—General.—The usual quarantine period is 10 days. The bacilli can persist in the bodies of recovered patients for three weeks; hence, to be on the safe side, convalescents should be isolated for a month.

The question of the destruction or disinfection of possibly infected fomites, such as clothes, skins, rags, &c., is important, for under certain conditions the plague bacillus possesses considerable vitality outside the body.

Cats and dogs should be kept away from plague patients.

The great question of rat destruction cannot be here considered in detail, but, so far as the use of traps is concerned, mention may be made of the value of tomatoes as a bait for rats. Portions of tomato can also be treated with phosphorus paste or other poison. Scraps of fish are also very attractive to rats. After a catch all rat traps should be immersed in boiling water to rid them of the rat smell, which effectually prevents the trapping of these suspicious rodents. The use of baited birdlime spread on boards has in some places superseded that of traps.

For destroying rats and fleas on shipboard a Clayton apparatus is necessary. It generates sulphurous acid gas under pressure; 3 lbs. of sulphur per 1,000 cubic feet is the usual allowance. A simple and rapid calculation is to allow 3 lbs. for each 10 tons of gross tonnage. The fumigation is continued for 12 hours.

Rat guards must be fixed on mooring hawsers and cables.

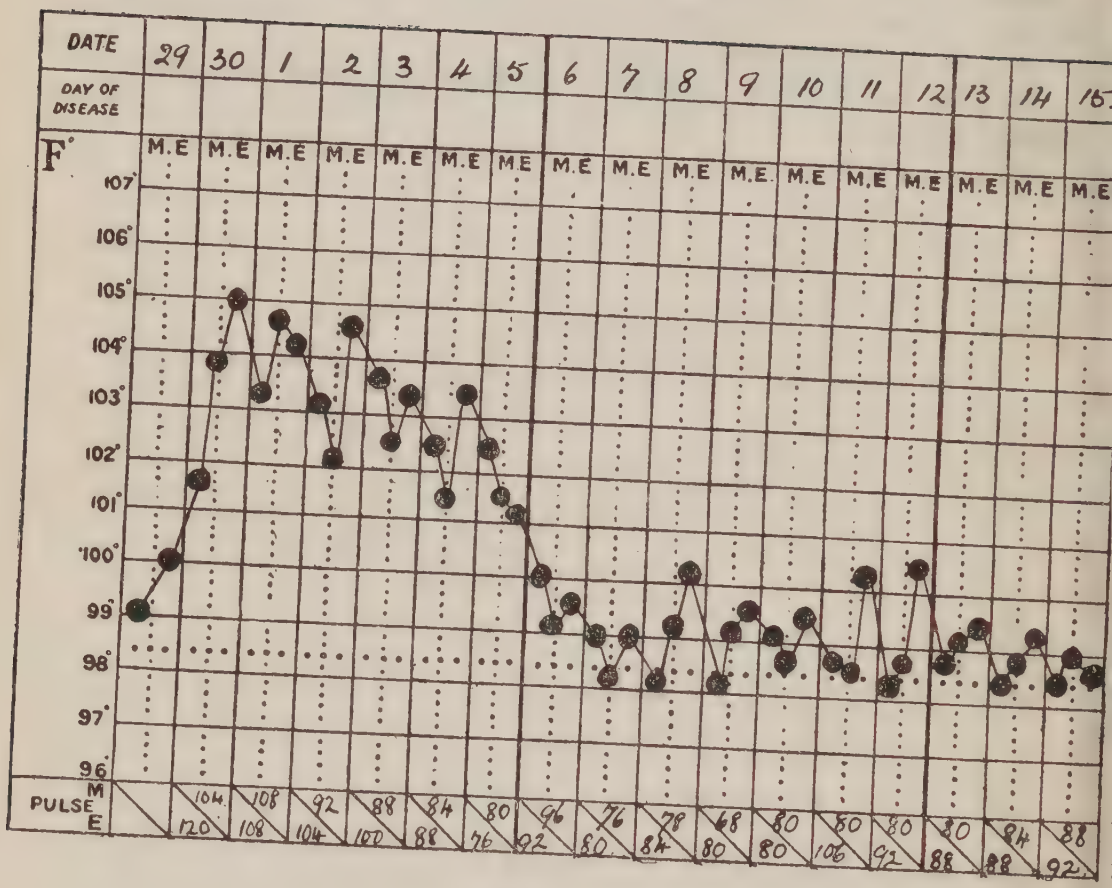
As regards pneumonic plague the freest ventilation is necessary, for it is in close atmospheres saturated with moisture that infection most readily takes place.

Treatment.—The only treatment which is really of any avail, and then only in bubonic plague and when given early, is the

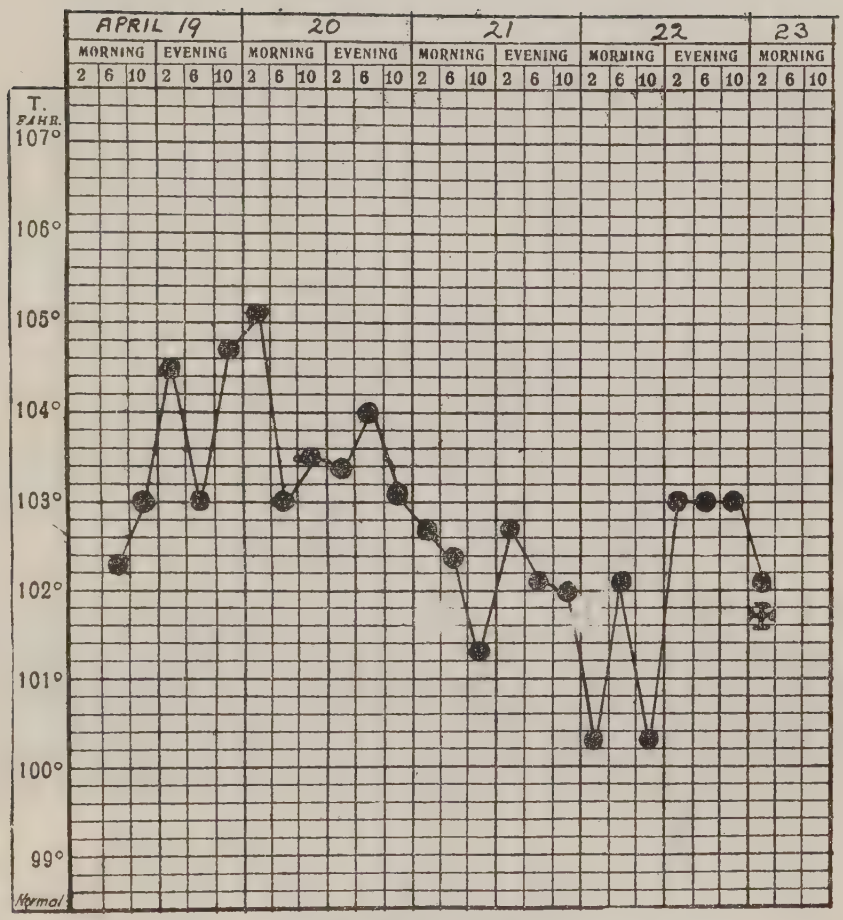
× white extract of squills, of which one-tenth of a
milligramme will kill a rat, and barium car-
bonate have also been employed in rat warfare.

administration of one of the antiplague sera, of which Yersin's and Lustig's are the best known. The dose must be large, 50 to 100 cc. or more. In desperate cases it can be given intravenously. The symptomatic treatment must not be neglected and is that for any severe febrile condition with certain special indications, such as the application of cold and of ichthyol ointment or belladonna and glycerine and their careful incision once suppuration is established and their careful aseptic treatment. Injection of iodine in the neighbourhood of buboes has been held to do good.

Morphia is the best hypnotic. Cardiac stimulants are nearly always required.


DATE
29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DAY OF DISEASE
F°
M.E
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
96°
PULSE
M 104 108 92 88 84 80 96 76 78 68 80 80 80 80 84 86
E 120 108 104 100 88 76 92 80 84 80 80 106 92 88 88 92

Bubonic.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107°
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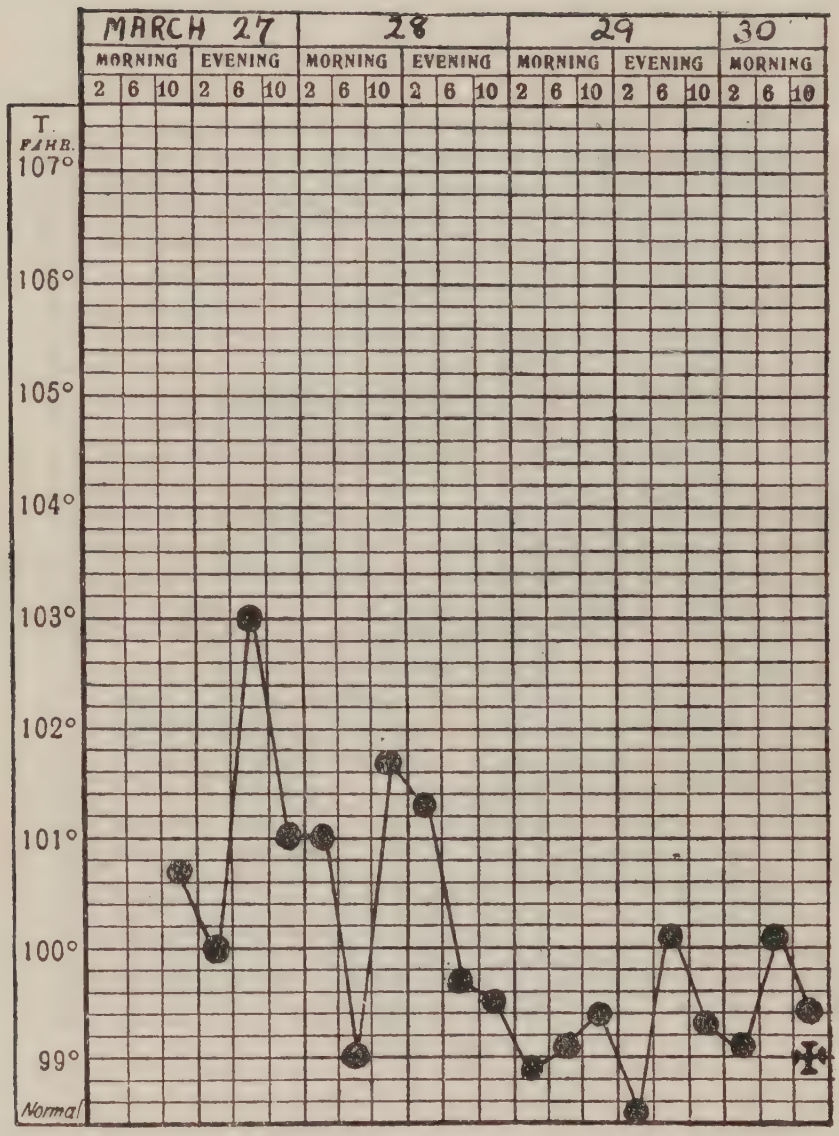
Normal

Pneumonic.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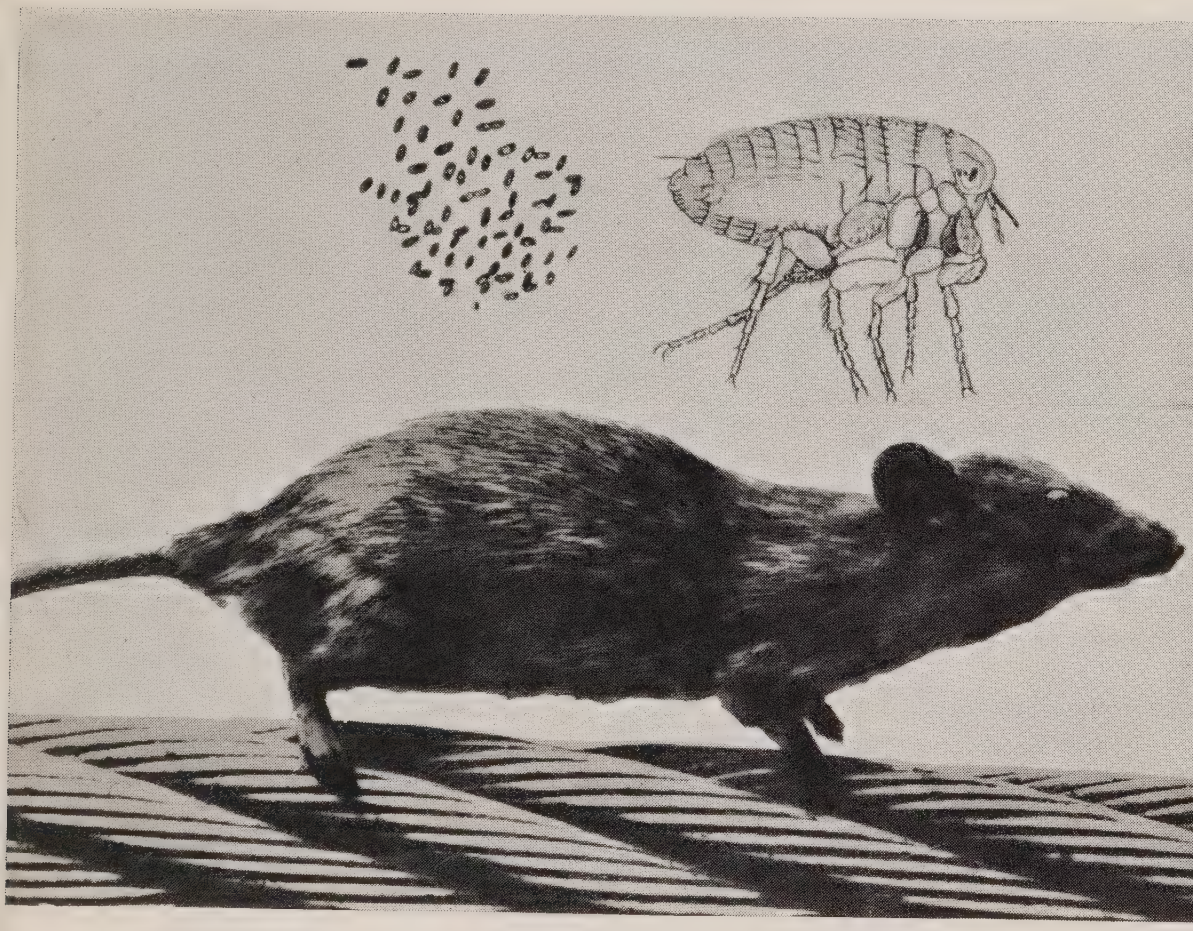
Normal

Septicæmic.

Fig. 25.



Bacillus pestis; Xenopsylla cheopis (female) and Mus rattus.

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This disease, the Oriental Sore is found in North Africa - from it has been very common amongst native labour corps in Egypt such a few cases have occurred in British troops.

in the European variety,
and in the Egyptian type Syn. Furbas.

Although there are slight differences between European & North African Relapsing fever the diseases are for all practical purposes identical & as the treatment for each is the same the European form only will be here described.

RELAPSING FEVER.

(SPIROCHAETOSIS.)

So far there is no record of this disease having appeared amongst the troops of the M.E.F. but with the extension of the campaign to the Balkans there is every likelihood that cases of what used to be called famine fever will occur. It has been recorded in the past from Salonica and Vodena. Like typhus the infection is conveyed by lice but unlike typhus the virus is definitely known, being the *Spirochaeta recurrentis* first described by Obermeier. (Fig. 26.)

Some state that bed-bugs also play a part in the transmission of the virus, but recent experiments in Russia tend to disprove this hypothesis. It is possible that they are occasionally operative but, if so, merely act as direct transmitters. There is no evidence to show that fleas act as vectors.

Incubation Period.

This is usually from 5 to 10 days but would appear to vary from a few hours to a fortnight.

Symptoms.

The onset is very characteristic, being remarkably sudden. The patient is taken with a chill or definite rigor, he feels giddy, an important symptom, he develops a bad frontal headache, pain in the back and limbs and he may and often does vomit. Occasionally convulsions herald the attack. A feeling of heat follows. His temperature shoots up to 104° or 106° and his pulse grows rapid, running at 110 or 120. He becomes seriously ill and is quickly prostrated and often delirious. His tongue is moist but coated with a white or yellowish fur. It is to be noted that, in contradistinction to what is met with in typhus, the tongue continues moist throughout the illness save in very grave infections. The patient is constipated, his skin is usually dry and jaundice may appear though it is often a mere conjunctival tinge. Thirst, restlessness and vomiting, it may be of blood, complete the picture but in a minority of cases there is an evanescent rash, either rose spots like those of typhoid or a reddish mottling.

Liver and spleen enlarge. The urine is scanty and high coloured. The appetite is poor but occasionally a voracious hunger is developed.

The patient may pass into a toxaemic state with tympanites and hiccough and eventually die, but usually, after an elevated temperature for 5 or 6 days, the first crisis takes place and is accompanied

by profuse sweating and sometimes by diarrhœa. The fall of temperature, often to subnormal, is both marked and sudden. There may be a descent of 10° F. in 24 hours. The change in the patient's condition is remarkable. His appetite returns and after a day or two he may feel so well that he is keen to get out of bed. After a week or so of apyrexia the first relapse occurs. Once again the temperature swings up and all the symptoms of the first stage are repeated, sometimes in a minor degree. Sweating, however, is usually more in evidence and the amount of urine passed is increased.

The temperature remains elevated for 3 or 4 days and then a second crisis occurs. The patient may thereafter become convalescent or he may have a second and even a third or fourth relapse but this is rare in the European form of relapsing fever.

In protracted cases convalescence is slow but as a rule it is fairly rapid and recovery is complete. The spirochaete is found in the peripheral blood during the paroxysms, can be stained by the Leishman or Giemsa stains, by carbol fuchsin or by alcoholic gentian violet. It is best demonstrated by the dark field method but with a little care and practice can be detected in an ordinary cover glass preparation, especially if a $\frac{1}{12}$th oil immersion lens is used, and the film is thin and well spread.

Complications.

Jaundice, severe diarrhœa, epistaxis, hæmatemesis and hæmaturia, parotitis, herpes labialis, pneumonia, meningeal irritation and ophthalmia may be mentioned.

Epidemics vary greatly in intensity. In time of war amongst starved and debilitated communities relapsing fever tends to be a serious disease, and the mortality, usually slight, may be very considerable.

Differential Diagnosis.

At the outset the disease may be mistaken for typhoid, typhus, or cerebro-spinal fever, but the peculiar course of the temperature is characteristic and the discovery of the parasite in the blood renders the diagnosis certain. Still it is worthy of mention that a recent outbreak at Salonica closely resembled cerebro-spinal fever; stiffness of the neck and hyperaesthesia being prominent symptoms. Occasionally relapsing fever may simulate plague and the two diseases may co-exist.

Treatment.

Nursing, diet and general hygienic measures as in typhus. After the crisis the patient is often ravenously hungry and, if so, it is important to regulate his diet carefully as injudicious feeding is apt to bring on bad diarrhœa and even dysenteric symptoms. Happily we now possess a specific which kills the parasite and cuts the disease short. This is salvarsan (kharsivan) which, as soon as the diagnosis is made, should be administered intravenously in a

a letter in wet or dry, thin or fine,

This is also true of relapsing fever & typhus.

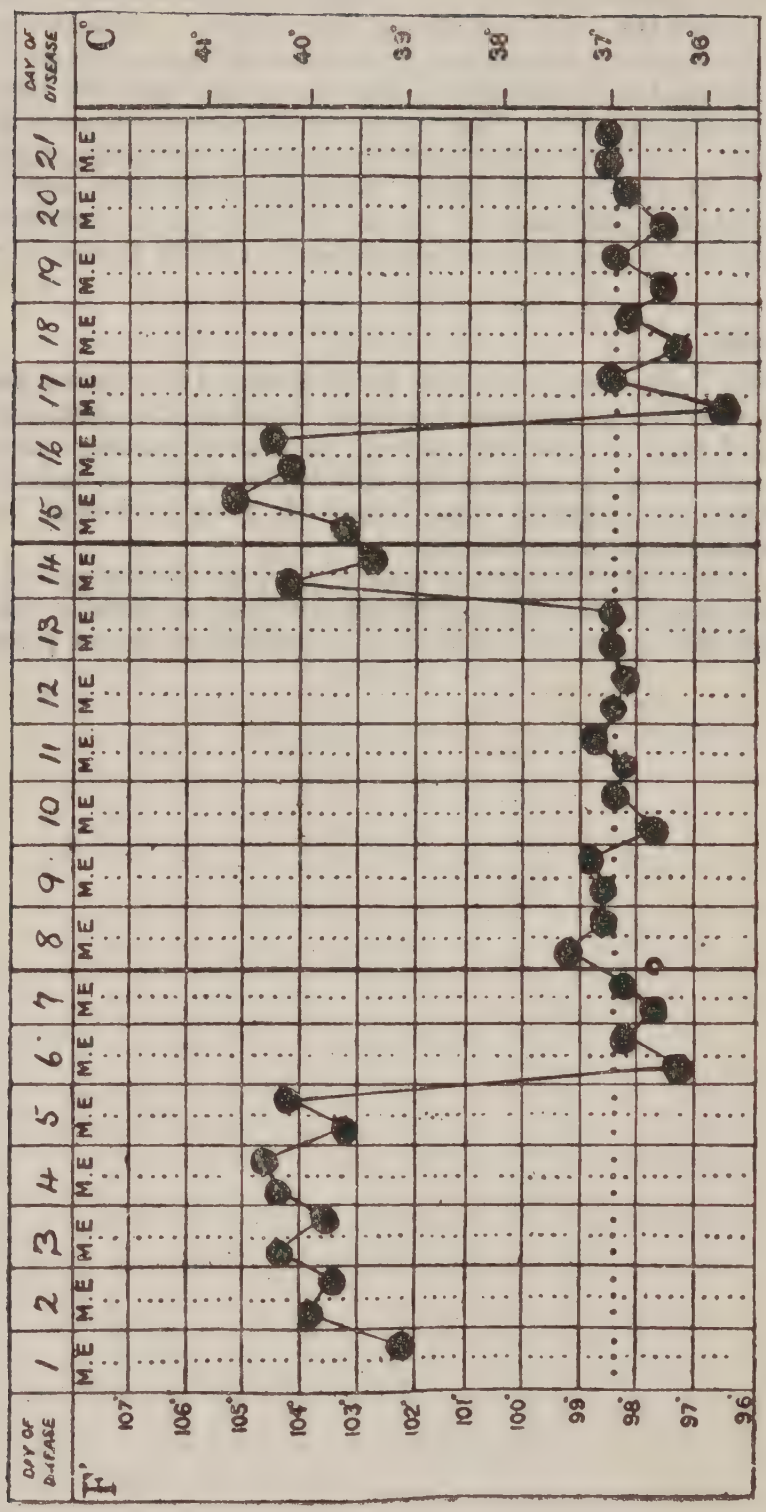
(In the Egyptian form 9 grain does have often been found necessary.)

dose of ~~from 3 to~~ 6 grains. One dose as a rule suffices. Even if albuminuria is present this line of treatment is not contra-indicated. If relapse occurs the injection should be repeated. Sometimes it produces a temporary but short aggravation of the symptoms but its action is rapid and certain. Ludyl or galyl may be used if salvarsan is not available. They are quite efficient in doses of from 4 to 7 grains. In debilitated persons camphor, ammonia, digitalis and stimulants may be indicated. Sometimes the back and limb pains demand the exhibition of opium. If hiccough is troublesome blistering over the line of the vagus on each side of the neck may be tried.

Prophylaxis.

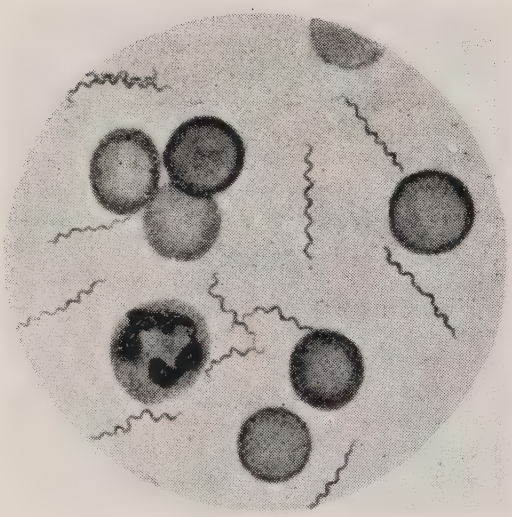
The disease being lice-borne this is the same as for typhus fever. Remember that the spirochaete has been found in the sweat and in the tears and that it has been proved capable of passing through intact mucous membranes and the unbroken skin. A case is on record where the disease was acquired from infected blood accidentally squirted upon the face.

As bed-bugs may occasionally play a part in the spread of the disease measures should be directed against them as well as against lice. These will be found detailed in the section on insect pests.



TYPICAL CHART OF EUROPEAN RELAPSING FEVER.

Fig. 26.



SPIROCHAETA RECURRENTIS IN HUMAN BLOOD × ABOUT 1,000

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SANITARY NOTES.

In this section no attempt is made to present an exhaustive treatise on camp sanitation. All that is desired is to furnish some information likely to be useful to those medical officers who have not had much experience in military sanitation under semi-tropical conditions.

The question of the disposal of excreta receives first attention, and when one remembers that in the tropics no less than 500 flies can breed out from a single deposit of human fæces, and that 4,000 of these pests can emerge from one-sixth of a cubic foot of sewage trench ground, it will be seen that the importance of the subject can scarcely be overrated. It is evident that to allow men even for a single day to defæcate when and where they please, or to permit them to make use of whatever kind of latrine appeals to them, is, under most circumstances, a grave fault, which may later have to be paid for by discomfort, invaliding, and it may be death.

Although in the trenches nothing of a very elaborate nature can be attempted, it should nearly always be possible to ensure that receptacles for human ordure have their contents protected from flies. At the very least a cap or cover of sacking can be improvised, and this may be soaked in cresol solution or in kerosene and placed over the tin after use. Any man neglecting so to cover a tin should be severely punished, for it is necessary to make the punishment fit the crime, and such neglect is a serious misdemeanour. A mere reprimand will not impress the true heinousness of his offence upon the soldier's mind.

In many places, however, there will be enough wood to make a small fly-proof box for covering and surrounding the tin. The lid should be so arranged that when the seat is in use it rests against the user's back and falls into position when he rises. Now wood soon warps and cracks and shrinks in a semi-tropical climate, especially when the nights are cool, and hence it is important to see that there are not gaps through which the flies can gain access to the tin contents.

The latter must be got rid of in the best way possible. As a rule, it is found most convenient to pit them. Where it can be managed a large and deep pit should be excavated wherein the excreta are thrown daily, soil added freely, and kerosene oil poured over all. This pit should have a close-fitting cover of wood or wood and sacking, and be constructed in a dark place where flies are unlikely to congregate. When the deposits have reached within 3 feet of the surface the soil should be rammed down hard, the pit filled up, the surface soil well soaked with kerosene (solar oil is kerosene with the inflammable benzines removed), and a new excavation made. The careful cleaning of the tins is most important, and if any ground is fouled during the process it should be drenched with kerosene. Further, the mop or brush or bundle of waste employed must be similarly treated. As a preliminary measure some oil can be poured into the tin and set alight. This chars the contents and facilitates cleansing.

Where space admits a better method altogether is to excavate a kind of alcove at the side of the trench, therein to dig a deep latrine pit and to establish over it a proper box seat. A simple measure is to have merely a flat, close-fitting wooden cover with an opening guarded by a sliding door. The men straddle across the opening. If enough wood is not available sacking may be employed to remedy the deficiency, as was done in one of the trenches at Anzac.

If, however, there is a sufficiency of timber, then an all-wood box should be constructed, and it may be said at once that this form which, if properly built and arranged, is fly-proof and wind-proof, is admirably adapted to the needs of camp sanitation in many places which our troops have to occupy. The only contra-indication would appear to be unsuitable ground and the danger of fouling shallow wells by drainage from the pit. Fig. 27 shows the general type, but the urine trough (the opening of which into the pit should be plugged when not in use) may often be omitted, as a better form of urinal is in vogue, and there is no need for the back rest. A little ingenuity will enable the lids to be made self-closing, even in its absence. This type of box latrine can be made double with two rows of seats back to back. The tin or galvanised iron strip is useful, but not absolutely essential. It serves to direct the urine into the pit. Note the shape of the box. In a single-row seater the back should be well sloped to the rear to avoid soiling with fæces. It is an advantage to set the lower box edges well into the soil all round the verge of the pit. If the earth there be crumbly place wooden sleepers under the box and have a foot board at the pit edge. The seats should be oval in shape, and a space of ¼ inch should

A convenient size of trench for a single ~~earth~~ latrine is one
9 feet long, 2 feet wide and 8 feet deep though, if desired,
it may be carried to a greater depth. In ~~very~~ sandy soils
revetment by means of sand-bags should be
adopted but the dimensions of the trench should
not be encroached upon. As systematic earthing
soon fills up the pit chloride of lime may be used
as a deodorant. If the pit contents for any reason
decompose & become malodorous it is advisable to
ventilate the trench by means of a pipe or shaft
which should open well above the men's heads. The
upper opening of which should be fly-screened.

When this is the case flies may be prevented from
getting access to their contents by covering them
transversely with well oiled or creosoted planks
fitting closely side by side, each having at its
centre a leather handle. The man removes one
board & straddles across the gap with his feet
on the adjoining boards. The latrine guard should
see that, before leaving, he carefully replaces the
board which he has removed. A convenient
size for these boards which should be of 3/4 inch plank
is 3' 4" x 9". A trench 10 feet long can be covered by
14 boards & will serve 6 men at a time.

be left at the seat hinges to allow for the swelling of the wood, which inevitably follows rain or the use of liquid disinfectants.

If the available ground is limited, and it can be managed, remove the cover every day, fill the pit with combustible material, such as straw, add 1 or 2 gallons of oil, and destroy the contents by fire. Otherwise a man must be told off to earth the pit ~~thoroughly~~ lightly night and morning and sprinkle some kerosene into it. Note that the kerosene so used will not prevent the development of fly maggots if eggs have been laid, but it will, and does, keep away egg-laying adult flies.

When the contents reach to within 3 feet from the surface ram down the earth hard, drench with kerosene, dig a new trench, and shift the box seat.

All sanitary paper should be kept in a box with a cover to it, and not allowed to become coated with fine dust.

Consider for a moment the disadvantages of such an open trench latrine as that shown in Fig. 28. It is offensive to the eye, attractive to flies, uncomfortable to the user by reason of these very flies, dangerous also because of them, and, despite the shielding canvas, on account of soiled toilet paper being swirled out of the pit by gusts of wind, and quite possibly leading to contamination of food and drink. Moreover, dried, infected dust may, in a similar way, be blown hither and thither with disastrous consequences. On all counts the open trench stands utterly condemned.

When the nature of the soil prevents the use of deep trenches it may be necessary to have recourse to a pail system, for the shallow trench should not be permitted in semi-permanent camps. At the same time it may be absolutely necessary to have recourse to it when troops are on the march. The pail system, even with the strictest care and most rigid surveillance, has its faults, for there is always apt to be fouling when the contents are emptied and the buckets cleaned, whatever the system adopted. The nuisance and danger can, however, be reduced to a minimum if solar oil or petroleum of some sort is freely and intelligently used, if, so far as possible, a time of day when flies are not very alert is set aside for the process, and if the material used in cleaning is subjected to thorough disinfection.

In this connection note the necessity, if the ordinary type of seat is employed, of swabbing its *under* surface well with kerosene or cresol. Pails must be made to fit closely under the seats, so that the floor, which should be of concrete, does not become fouled by urine. There should be in the floor some kind of check, such as an iron stop-pin, against which the base

of the bucket will impinge, thus ensuring that it is in its proper place. It is advisable to reduce the seat to a minimum, as the less wood the better. The floor washings should be led by a channel to a covered pit, and the pit should be made with a punch-bowl depression in it to facilitate emptying.

Paper in the pails should be set on fire thrice daily, as this greatly helps to prevent nuisance and danger from their contents.

Cresol solution is not so good as solar oil or crude kerosene, but if it is used the strength should be a quarter of an ounce to the gallon, and sufficient should be added to cover the fæcal mass.

In the case of hospital camps and large aggregations of men carting of the pail contents to a place of disposal is usually necessary. Latrine carts are apt to be insanitary Juggernauts, but again the use of kerosene will greatly help, as will careful inspection to see that the cart is in good condition, that its lid fits properly, and that it is thoroughly washed and cleansed and oiled well away from camp precincts. Spilling from pails, and also, it may be said, from bed-pans being carried to the laboratory, constitutes a grave nuisance and danger.

The trenching ground is another trouble, but here, under proper supervision, a system of shallow trenches may have to be permitted in lieu of anything better. The discharge of the pail contents into large pits, where the surface of the deposits is kept covered by a layer of crude petroleum, has something to recommend it, but without incineration, and indeed even with it, at least as usually carried out, the pail system is not an ideal method. It need hardly be said that all battered and bulging buckets must be at once withdrawn from use, for they are difficult to clean, and soon get into a leaky condition. Where the pail system is run on a large scale air-tight covers should be provided for the buckets, as in the well-known Duckering pattern.

A method for the disposal of pail contents, and which may be used in an emergency is a combination of pitting and incineration, and this method, called the "American oil-pit," may also be used in the case of deep trench latrines, where incineration is desirable, and if the fumes are not found too disagreeable. For disposal on the large scale, pits 4½ feet deep, and from 10 to 12 feet square, are dug. Each is provided with a false bottom of perforated stout gauge corrugated iron sheets. The urine runs through the openings. Paraffin oil and other combustible material is added and set alight. The burning oil evaporates the urine, and the fæces and combustible material are reduced to ash.

Where Kerosene tins are used instead of pails each tin should be furnished with a wooden strip on either side. These strips engage with grooves on the under surface of the latrine seat & the tin is slid into position. In this way it hangs supported from the seat & the floor is left clear.

An alternative method is to convey the sewage directly to a ~~[illegible]~~ covered cesspit.

29a. 29b

A more elaborate method, which might be tried in certain places, is to have a long, lined pit, 4 feet wide by 21 feet in length, with a steel floor, and under it a narrow chamber, wherein three "primus" blowers, burning paraffin, generate an intense heat. Such oil-pits must be some distance away from tents and huts as they are often offensive.

A recent and ingenious modification of the pail system is that introduced by Surgeon-General Macpherson, the type of latrine being described and illustrated in the Journal of the Royal Army Medical Corps for October, 1915. By this method latrine contents are destroyed by individual incineration. The method, which is sufficiently indicated in the drawings, Figs. *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h* and *k*, is economical and well adapted for small units, but requires careful and constant supervision. Dry refuse, as well as excreta, should be burned in the incinerators, as this helps to diminish smell, always an objectionable feature of an incinerator which does not possess a combustion grid or chamber. Where the nature of the subsoil permits, the urine tins may be connected with pipes leading directly to a soak-pit, thus further simplifying the design.

Another separation method is that devised by Sharp on the plea that it is the admixture of urine with the fæces which causes most of the trouble when incinerating. The idea is sufficiently indicated by Fig. 29.

Where the needs of a comparatively small number of people have only to be considered, as, for example, in connection with a medical or a nursing staff, there seems no reason, provided barrels are available, why the system shown in Fig. 30 should not be adopted. One of these closet septic tanks has been tried at Mudros East, and instead of the wire screen a perforated carbide of calcium tin was used quite successfully. The anti-splash board, which is pushed down when the closet is not in use, may be conveniently operated automatically along with the lid. If used separately there should be a check, so that it will rise to within a couple of inches of the surface of the water and no further. The water surface in the barrel must be covered by a layer of oil to check odour and keep flies away.

It is wonderful how rarely the barrel has to be cleaned out. A metal effluent tank can have its contents boiled, and for this purpose may be provided with a water gauge. Then, being harmless, the effluent can be discharged anywhere, so long as a mosquito-breeding pool does not result. This is a cleanly and agreeable method and requires very little attention. Whatever type of latrine be used, it is a good plan to have some place outside it where men who may be "carriers" of disease can wash and disinfect their hands. Fig. 31 shows a simple arrangement.

Returning to the question of incineration, we may note that one of the most satisfactory types of incinerator is the Horsfall, which is provided with a baffle plate separating the furnace from the bottom of the flue, and thus providing a combustion chamber. The ordinary B 3 type readily disposes of the excreta of 1,000 men per diem, provided the urine is drained away from the solids. This is easily done by emptying the pail contents into a perforated receptacle kept specially for the purpose. The liquid drains away, aided by pressure, and is then run into a funnel provided with a sieve, on the top of which a layer of straw or similar material is placed to catch any solids. The funnel communicates with a soak-pit, into which the urine passes, and the filtering material is burned. Wood shavings or any kind of combustible rubbish may be added to the pail contents, which are rapidly consumed without the production of any nuisance.

Emergency " Horsfalls " are easily constructed from bricks or petrol cans, filled with a mixture of ash and clay and wired together. The all-important point is to ensure that a proper combustion chamber is present (Figs. 32, 33, 34 and 35), for by its means the gases are oxidised and rendered inodorous.

There are many other types of incinerator. The Sialkot pattern is well known. The metal receptacle with the tap may be omitted, or can be utilized as a source of hot water. There are other simpler forms, but none work so well as the properly managed Horsfall, and they all require greater care in feeding and stoking.

Much depends on how an incinerator is run, and it is advisable to give a little extra pay to the man in charge of it in order to secure the best results.

Urine Disposal.—By far the best and cheapest type of camp urinal for general use is made by driving a tent peg through the bottom of a petroleum drum and setting this at a convenient height on a clay pedestal, down the centre of which runs a channel formed of ordinary tins attached end to end. This communicates with a soak-pit, 3 feet cube, filled with rubble or graded stones. Fig. 37 shows such urinals. An alternative method, not as easily realised at places like Mudros and the Peninsula, is to have funnels communicating with the pit.

Refuse and Sullage Disposal.—Refuse, and especially kitchen refuse, is best burnt in a Horsfall, or, failing this, in one of the small type incinerators, the cross-bars of which should not be set too wide apart. Two inches between each is ample. Wire netting can be used if fire-bars are not available, but it soon burns out and has to be replaced.

The best way to get rid of horse manure, which, owing to the litter usually mixed with it, may be partly considered under this

Fig. 37.

[To face p. 113.]

Further purification can be effected by the use of slaked lime or bleaching powder together with an upward or downward filtration through rubble or gravel.

heading, is a vexed question. Burning is very desirable, but difficult of accomplishment unless the mass can be loosened up in some way, as by dealing with it on wire netting or spreading it out in thin layers. The addition of paraffin is advisable, and with care and attention a great deal can be done. The question of manure from the fly-breeding standpoint will be discussed immediately.

Sullage is always one of the problems of camp life, especially the soapy waste water from laundries and washing benches and the greasy sullage from kitchens.

Methods of disposal must be suited to the locality, and information regarding these methods is given with appropriate illustrations in the Manual dealing with Royal Army Medical Corps Training, pp. 73-77, and in Major Lelean's "Sanitation in War." All that need here be said is that it is advisable to have an easily removable wooden box cover over the grease trap in places where flies are numerous, and that the absorbent filter may consist of grass, straw, hay, small twigs, or any similar material, which can afterwards be burned. A useful type of washing-trough, lined with zinc and communicating through such a grease filter with a soakage pit, is in use in the Indian camps at Marseilles.

Swill tubs and barrels should not have flat wooden lids, which warp and crack, but caps made of canvas, which can be soaked in kerosene, and which effectually exclude flies.

Flies.—Apart from what is stated in the section on Insect Pests, there are some points about flies well worth consideration, for remember that flies mean filth, and, what is more, local filth. Many of them are bred in filth and begin life infected. All of them feed on filth when they can get it, act as mechanical carriers of it, and regurgitate and excrete it, for the fly largely spends its day vomiting and defæcating. Before feeding, the fly imbibes liquid, and its diet, like that of a typhoid case, is fluid. Part of its alimentary tract is really a kind of mixing tank, water and liquid food being pumped to and fro in the proventriculum before the emulsion reaches the stomach.

A single female fly lays 120 eggs in one batch, and during the year she may lay four such batches. Taking only one batch, let us say that half the flies which hatch out, *i.e.*, 60, are females. Provided the progeny of these 60 females and that of succeeding generations all reach maturity, the original mother fly would in six months become the ancestress of no less than 5,598,720,000,000 adult flies. Consider what this means and make the complete calculation for all four batches. It will then be evident that delay in fly-prevention is fatal.

Here is another interesting bit of statistics! Manure not

more than 24 hours old produces, during the warm months *in a temperate climate*, an average of 10,000 to 12,000 flies per cubic metre. It has been estimated that one horse can produce sufficient manure to give rise, in summer, to from 40,000 to 50,000 flies a month, fresh manure alone being suitable for breeding. This latter point is important, and in a dry country like Egypt horse manure is not such a very marked source of flies. Quite recently interesting experiments have been conducted which have led to the following conclusions :—" The heat of fermentation of a manure heap can be used for the destruction of the contained larvæ. The larva, submitted in the manure to a temperature of 50° C., and protected from the gases resulting from fermentation, dies in 3 minutes; in direct contact with the gases, it dies in 1 minute at 51° C., and in 4 or 5 seconds at 60° C. If the manure be turned over, larvæ which fall into the hot parts of the interior are killed instantly. This practice, if carried out during the first three days, would result in the destruction of 90 per cent. of the larvæ. The operation is rendered easier if the manure coming from the stable be treated directly with the heat of fermentation of a heap already formed. The fresh manure should be covered by a layer of hot manure about 20 cms. (8 inches) in thickness; the heat is then readily communicated to the fresh material, in which the eggs are killed before they can develop, and the fresh material is also protected against further oviposition. This biological method of destroying larvæ by heat is equivalent to an accelerated and total heating of fresh manure up to 50° or 60° C., carried out without the expense of any combustible material."

Adult flies can be trapped and killed on manure heaps in dry weather by placing in inverted tins pieces of bread soaked in 1 in 40 solution of the commercial (40 per cent.) formalin, to which sugar or molasses has been added. On windy days the tins should be placed in the lee of the heaps.

It may be possible, at the early part of the fly season, to trap and fumigate adult flies on a large scale by the use of heated and baited fly huts, which are so arranged that flies can enter them but not leave them. Experiments are now being carried out to test their utility. Fig. shows a simple form.

Mention may be made of canvas strips or string frames poisoned with arsenite of soda solution; balloon wire fly traps, baited with equal parts of cheese and sugar made into a paste with water, casein having proved very attractive to flies, or, where it can be got, stale beer with sugar; the use of 5 per cent. sweetened formalin solution scattered about in droplets or soaked into bits of bread and " swatting " with the wire-netting fly flap.

A simpler method is to stack the manure in a compact mass, then to cover it thoroughly with a thick and evenly spread layer of oily earth or sand. This is prepared by mixing one measure of oil to 40 of dry earth or sand. Use 1 gallon of the oily earth or sand to every 2 sq. ft. of manure surface/

could be placed out-of-doors in the sun, baited with any attractive bait, such as chicken entrails, fresh meat, damp tea leaves, old cheese, stale beer etc. The flies can be killed by introducing a syrup of arsenite of soda or 3 per cent formalin or by spraying with Lysol fluid. One of these traps has been known to catch 10,000 flies in 2 hours, this quantity of dead flies just fills a pint measure. For further particulars see Jl. R.A.M.C. July 1916.

While in the subject of cork floors the necessity for the provision of a hard, smooth floor such can be easily enough may be insisted upon; also the desirability of dividing by a fence or wall of some kind and of arches in camps.

On a large scale a metal railway may be laid by which from a locomotive motor an excellent disinfecting chamber can usually be secured in place when railway exists. It accomplishes far more than a portable steam. After each of these chambers can readily be steamed.

A word as to cook-houses, which are too often black with flies. It is probably a mistake to screen them, for they merely become fly traps. It is far better to keep them dark, to arrange for a good draught through them when it can be managed, and to protect the food itself by wire covers and the provision of screened cupboards. It is said that flies are to some extent kept out of cattle-sheds by whitewashing the walls with milk of lime, to which alum is added in the proportion of 2½ lbs. for each 3 gallons of lime, and this mixture might be tried in cook-houses, which, in addition, should be sprayed or torched, for at dusk it is quite possible to singe and burn large numbers of flies on a roof by means of a flaming torch without risk of fire. They fall to the ground, and are swept up and destroyed. As a spray, Solution " C " or a solution of formalin, 2 ozs. to the gallon, is useful.

Another method for buildings introduced by Major Needham, I.M.S., is to catch flies wholesale in a mosquito-net, using it opened out as a drag or sweep net. The flies rise, fly into the open net, and are then quickly killed by rolling the net up with a whirling motion as when handling a skipping net. The dead flies can be burned or emptied into a bucket of cresol or kerosene. In the case of tents the net is spread over the entrance of the tent, and someone inside the tent drives the flies into it, when it is rolled up as before. Carcases and carcase flies should be sprayed with Solution " C."

Vermin.—Fig. 36 is an illustration of a French modification of the barrel disinfector which is very effective, for sulphur fumes are deadly to lice.

In fumigating buildings infested with lice sulphur may be used, at least 1 lb. of sulphur to every 1,000 cubic feet. The clothing can be hung up loosely in the building at the same time, as the fumes are said to kill both lice and eggs under such conditions.

Water.—It is considered unnecessary to enter fully into the subjects of water supply and water purification here, for they are fully and ably handled in Major Lelean's Manual, which is so generally used, but it is well to impress on Medical Officers the necessity of making themselves familiar with the rationalé and technique of the chlorination process. Many seem to think that it is free chlorine which kills the bacteria in the water. This would not appear to be so. The bactericidal action is due to hypochlorite and to the process of oxidation which takes place, for the total oxygen is liberated from the hypochlorite. It is necessary to see that the test solution keeps its strength and

acts properly, and frequent inspection is always required to ensure that the process is properly and intelligently carried out.

Another point requiring attention is the necessity of cleaning out water storage-tanks at definite and not too lengthy intervals. When it is remembered that Escomel, in Peru, traced an epidemic of dysenteric diarrhœa to trichomonas flagellates found in such tanks, it is clear that every care must be taken. Emptying and scouring is usually sufficient, but in case of any suspected infection permanganate (1 oz. to 2,000 gallons) or iodine solution (1 in 1,000) may be employed.

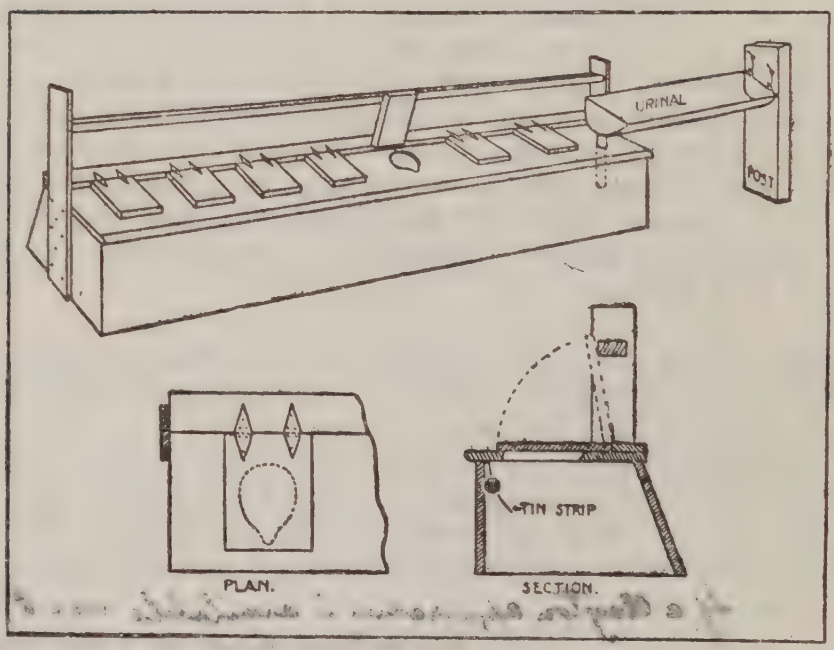
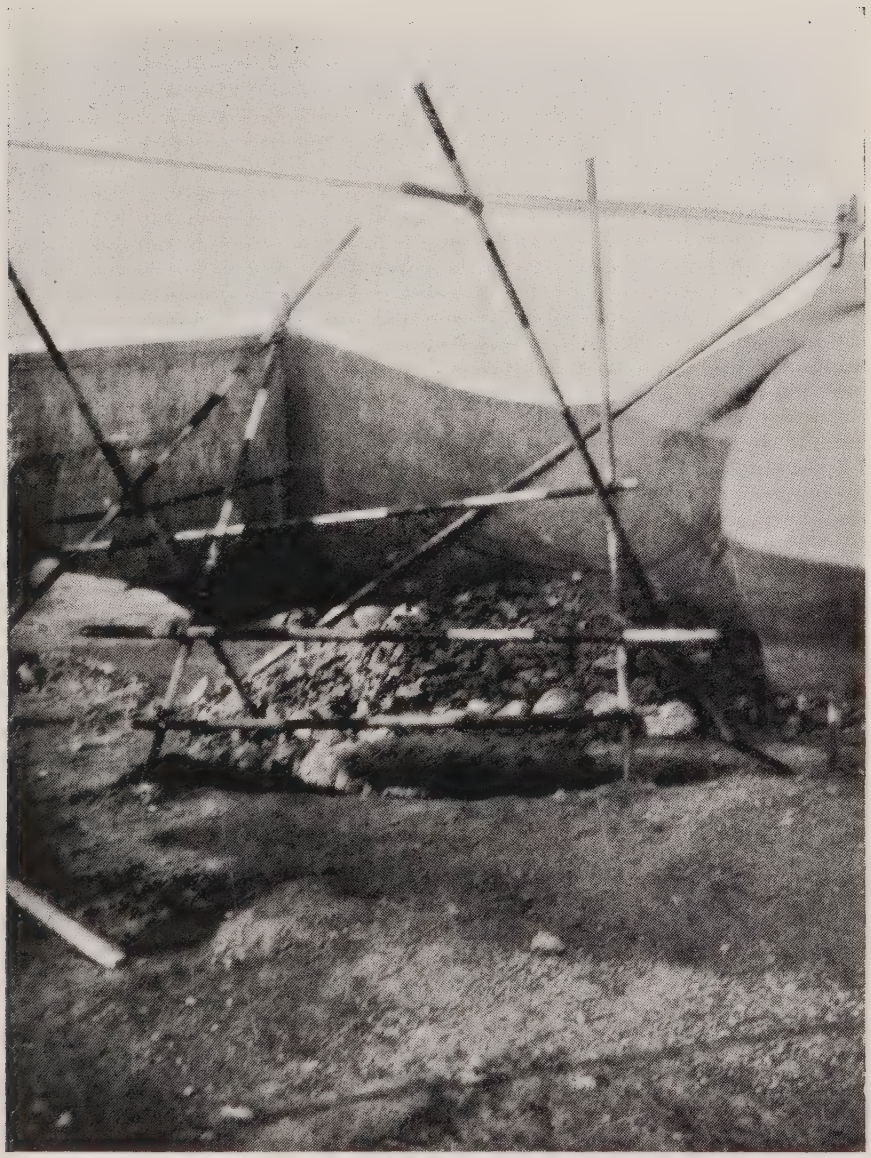


FIG. 27.—Box seat cover and urine trough for company pit. Note shape of seat, self-closing cover, slope of back, and tin strip. (After Straub and Miller.)

This seat is placed over a deep trench thus rendering the Cattle fly & mud proof.

Fig. 28.

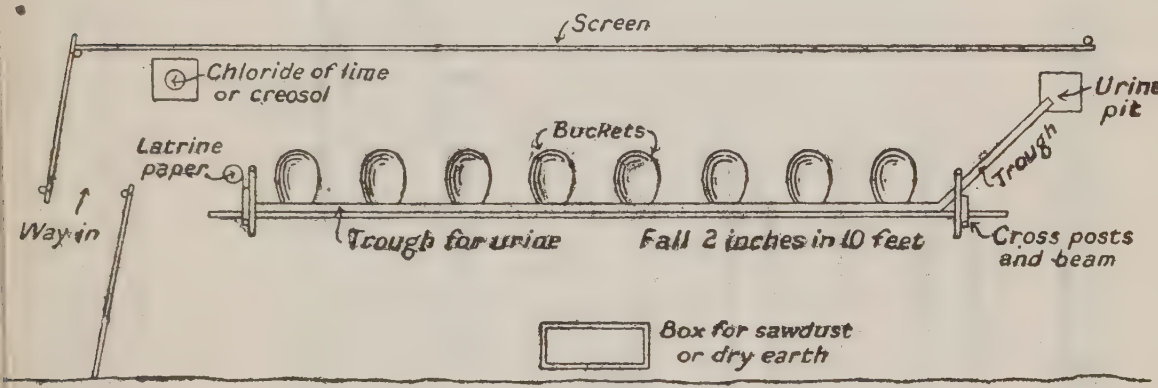


Open Latrine.

To face p. 117.]

NEW LATRINE FOR USE IN CAMPS, BY LIEUT.-COL. A. D. SHARP, R.A.M.C. (T.F.).

Diagram of latrines for keeping separate urine and fæces.



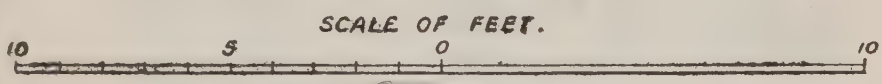
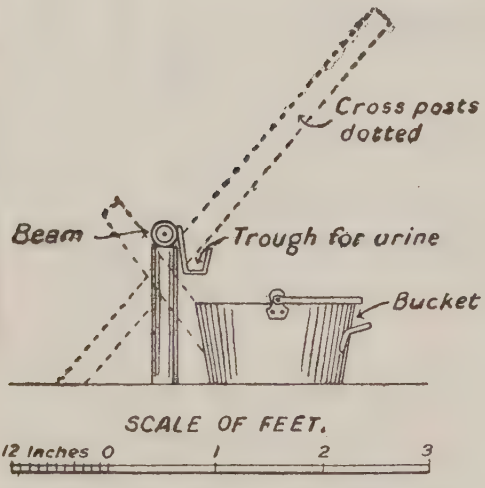


FIG. 29.—Plan of latrines.

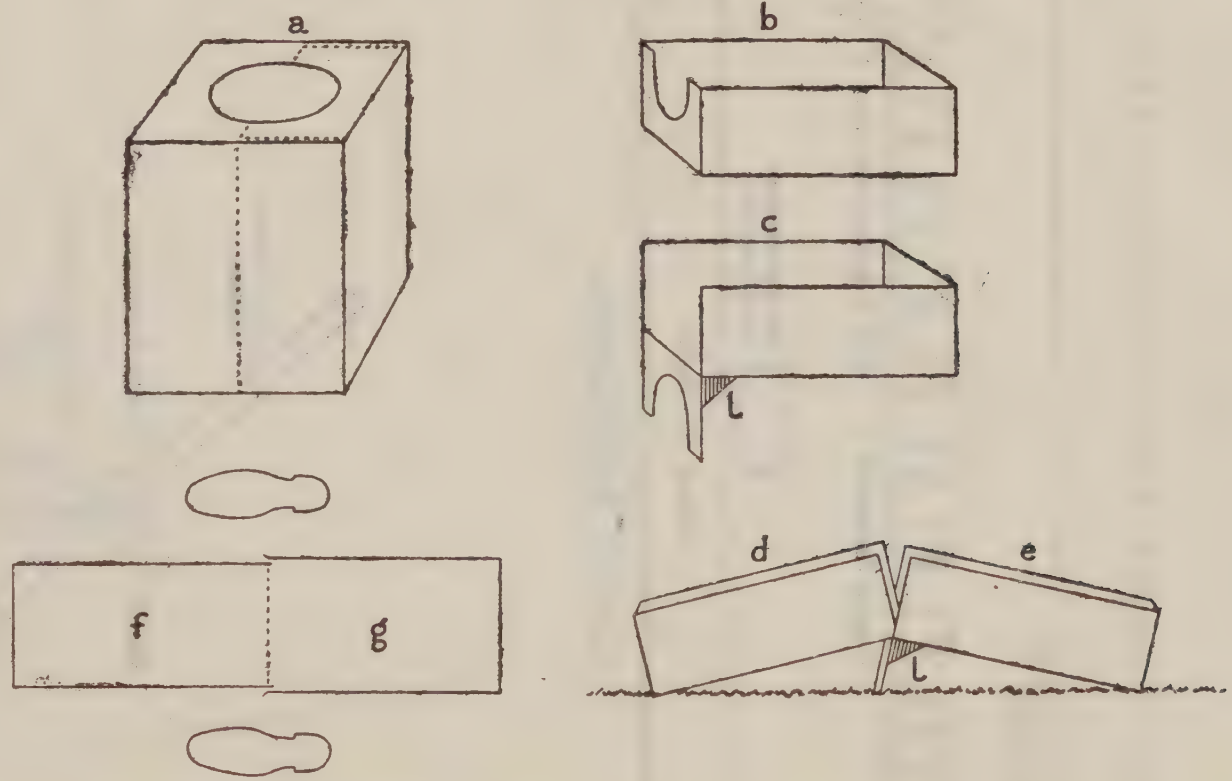


Detail section through urine trough.

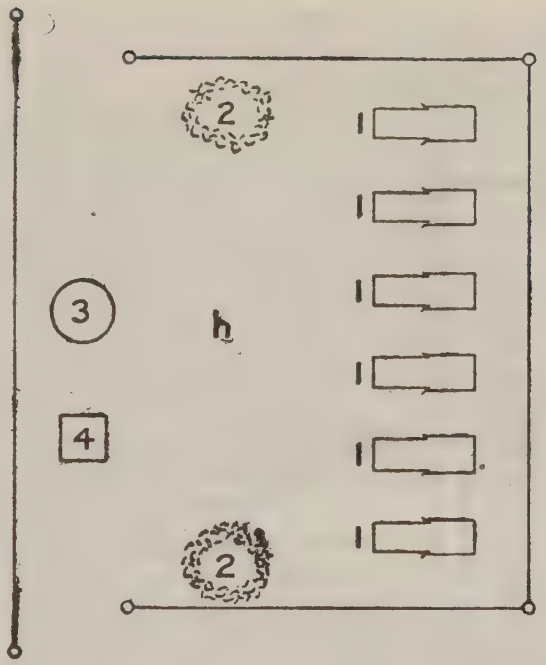
Transfer

Fig. 29a.

A System of Latrine Construction for Disposal of Latrine Contents by Individual Incineration, by Surg.-Gen. W. G. Macpherson, C.B., C.M.G., K.H.P.

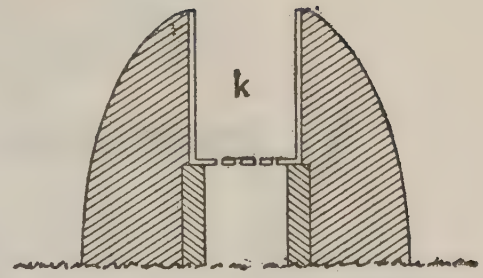


a=Biscuit tin cut along dotted lines.
b and *c*=The two trays thus formed.
d and *e*=Method of placing the trays on the ground, as latrine receptacles.
f and *g*=Plan of trays placed as latrine receptacles with position of feet a-straddle.
In tray "*g*" a bed of straw or other dry combustible material.
l=Triangular piece of tin soldered on to tray to strengthen foot piece.



h=Plan of a latrine-screened enclosure—

1. Trays in position.
2. Heaps of straw or other material for placing in the trays, as at "*g*."
3. An incinerator, as "*k*."
4. A urine absorption pit or receptacle



k=An incinerator of empty paraffin drum with perforated bottom, standing on bricks, and built in with puddled clay.

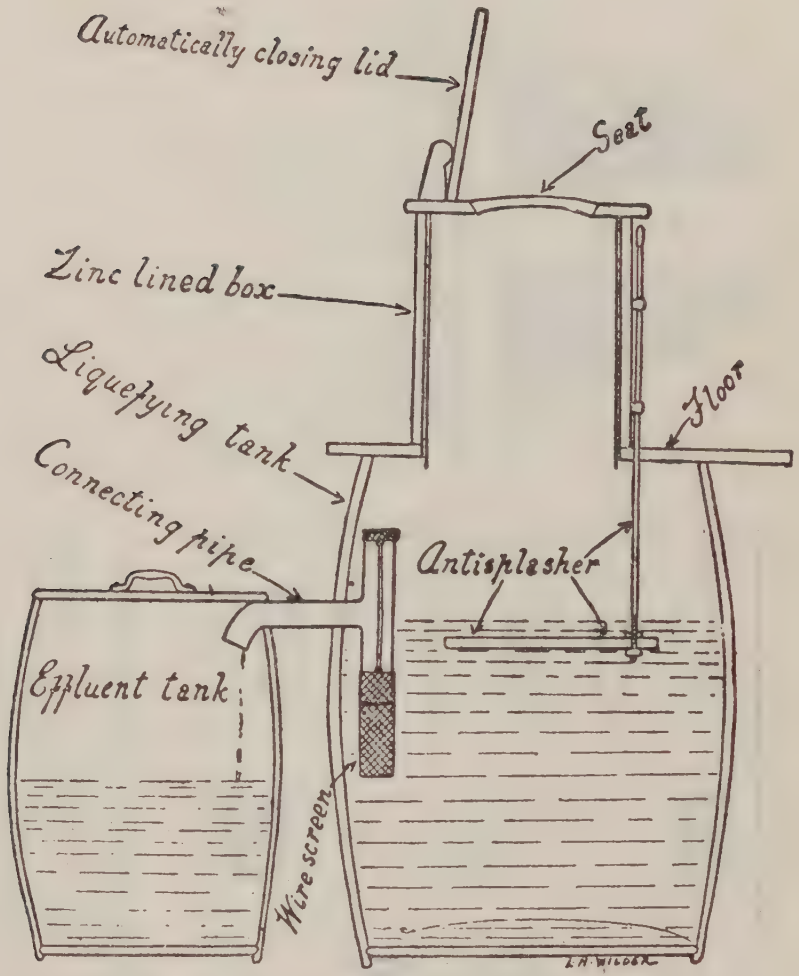
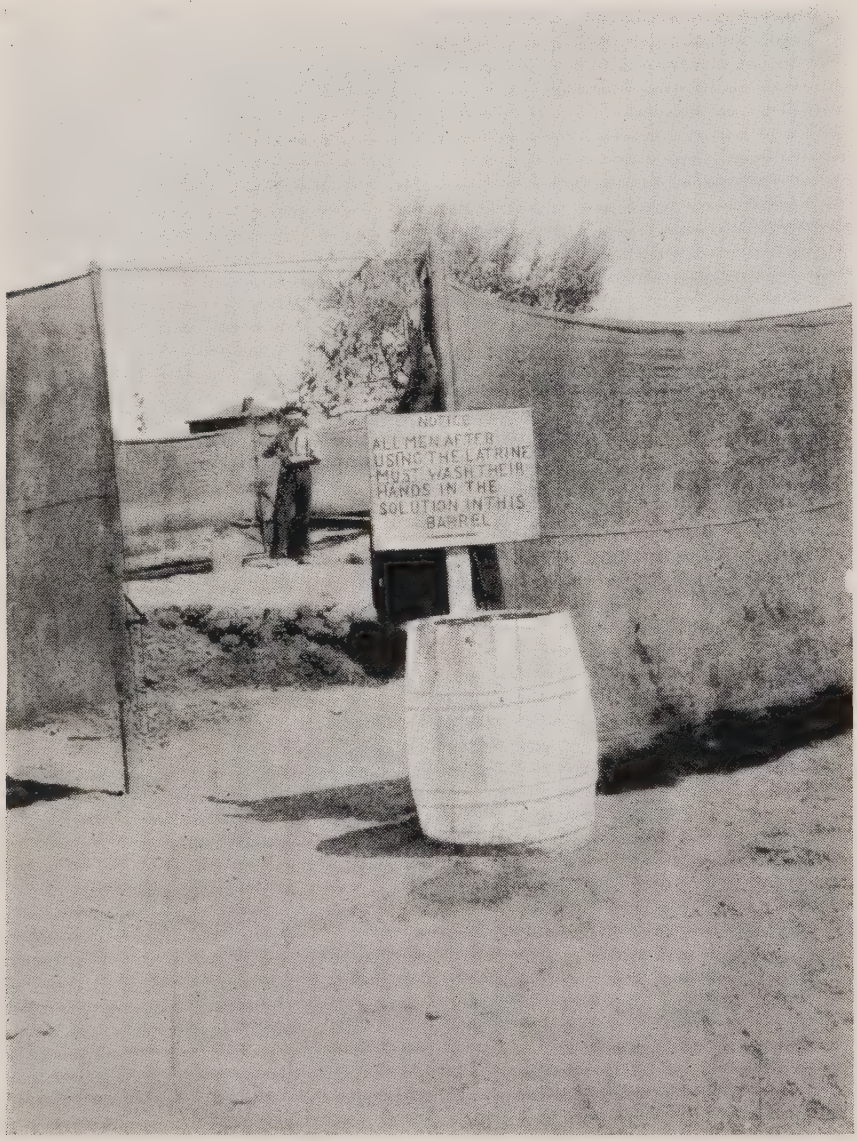


FIG. 30.—Closet devised by officers of the United States Public Health Service. (Lumsden, Roberts, and Stiles.)

Fig. 31.



Carbolic solution for hand disinfection.
A sink-trough would be a useful addition.

To face p. 121.]

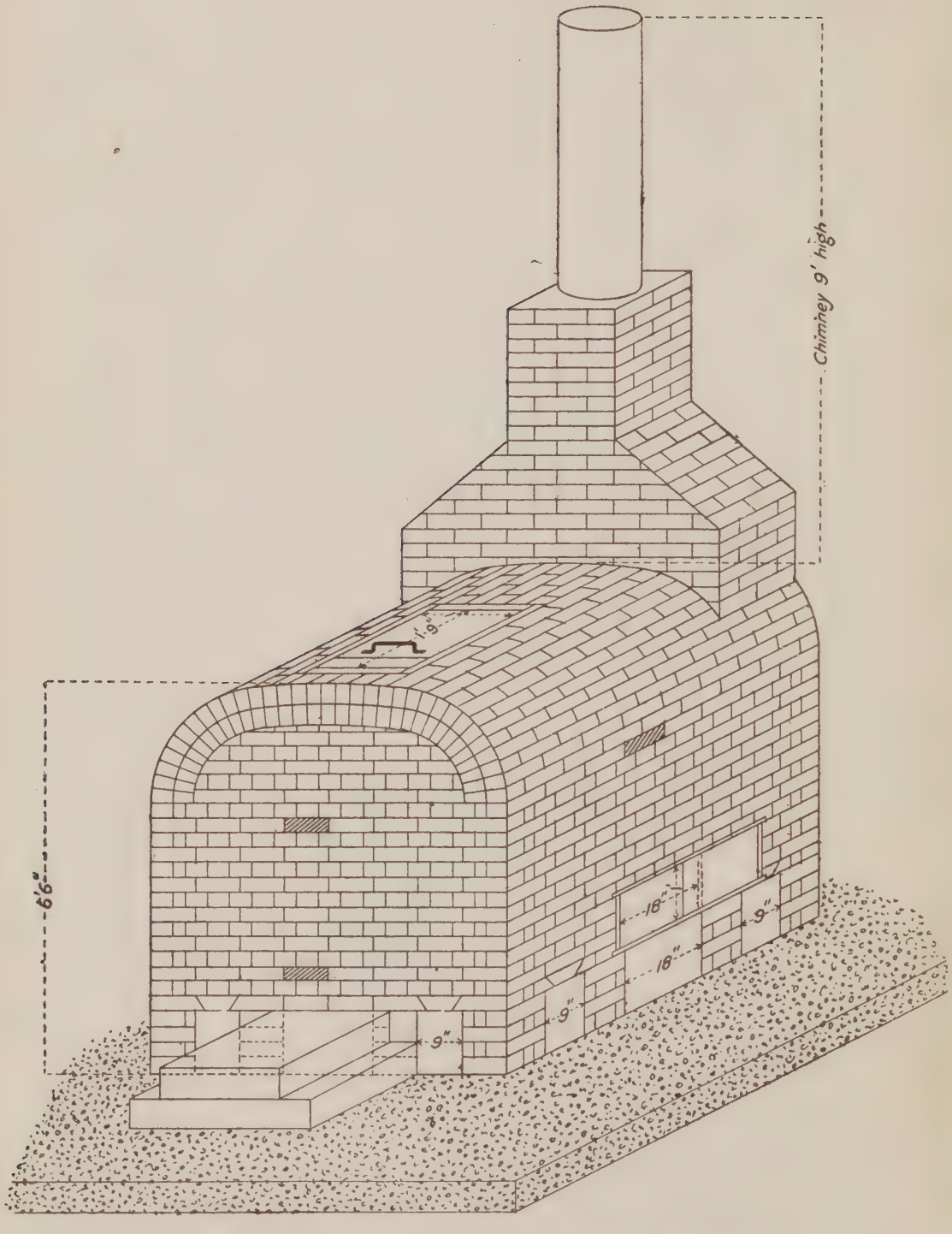


FIG. 32.—Perspective Elevation of Brick Destructor.

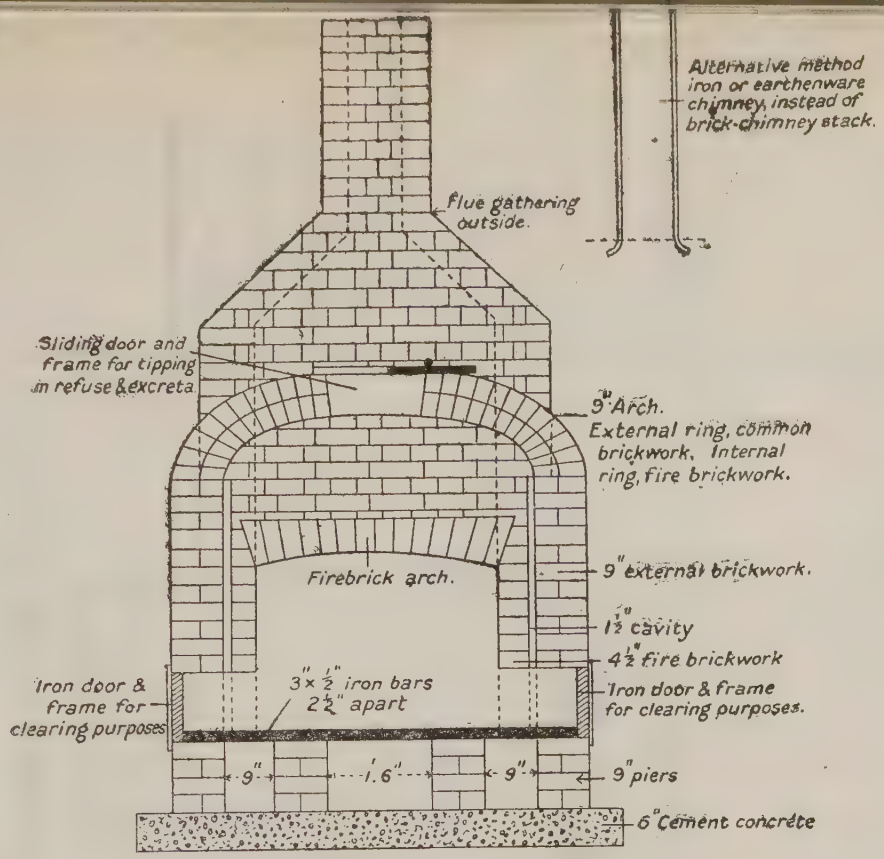


FIG. 33.—Section.

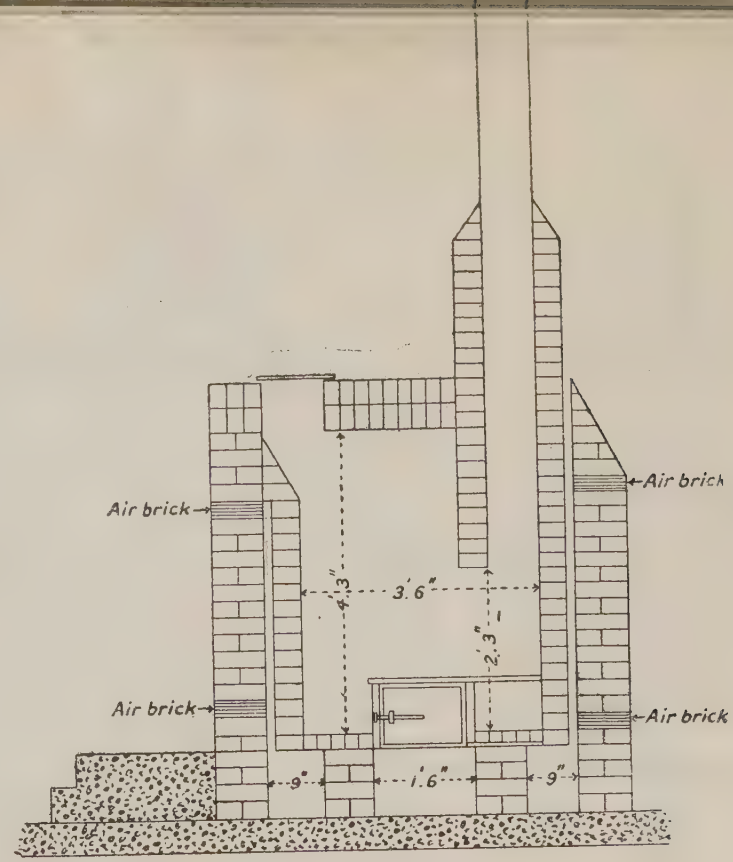


FIG. 34.—Section.

Materials required to build destructor :—

Common bricks, 9 inches by 3 inches ...	1,500
Fire bricks	400
Iron sliding doors with frames	
Air bricks, terra-cotta, 9 inches by 3 inches	
Iron for bars, 3 inches by ½ inch	70 feet
Iron chimney—diameter, 1 foot 9 inches; height, 9 feet	1
Washed sharp sand	½ load
Cement	½ bag
Fire clay	2 sacks

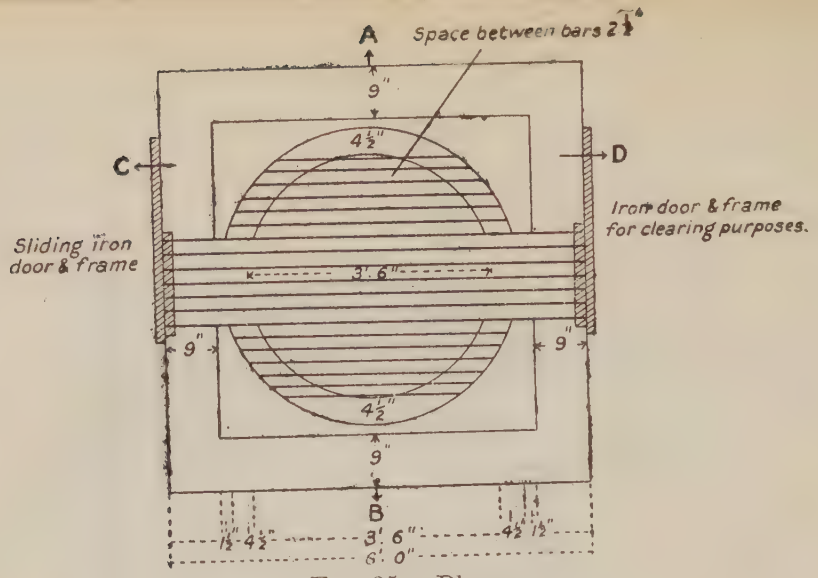
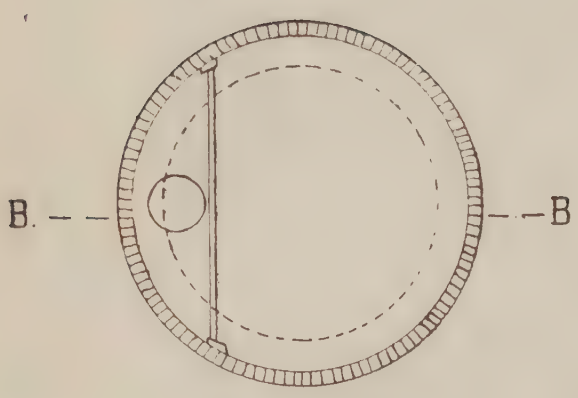
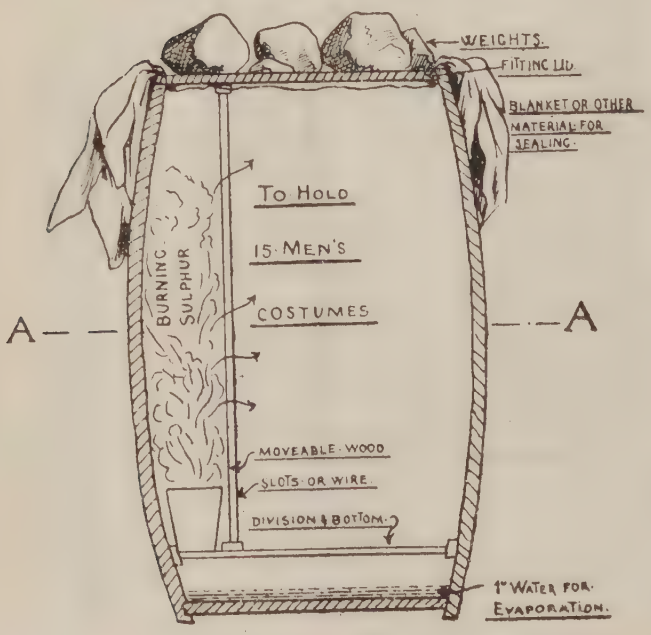


FIG. 35.—Plan.



PLAN AT A A



SECTION B.B.

DATA.

25 GRAMMES (NEARLY 1 OZ.) SULPHUR PER CUB. METRE CAPACITY.

METHOD OF USE.

ESSENTAL THING IS TO GET HERMETICAL SEALING IN USE THUS: WELL FITTING LID OVER BLANKET. HEAVY WEIGHTS ON TOP.

BARREL WELL SOAKED TO ENSURE TIGHTNESS OF STAVES. GARMENTS LOOSELY DROPPED IN TO ALLOW SULPHUR GAS TO PENETRATE.

FIG. 36.—From a drawing by Mr. Schwarz.

TYPHUS FEVER.

While there has been very little typhus fever amongst troops serving in the Mediterranean region, it may confidently be expected that the disease will be more in evidence throughout the winter and in the new area of hostilities. The infection is conveyed by lice and it is probable that they constitute the only means of spread. The causal organism is not yet definitely known, but the anaerobic bacillus recently isolated by Plotz and studied by Olitsky and Baehr may prove to be the etiological factor. The evidence adduced in its favour is certainly strong. On the other hand, many believe that the disease is due to an ultramicroscopic filter-passer and its conveyance by, and apparent development in, lice possibly favour this hypothesis.

Incubation Period.

This varies between 5 and 14 days, 12 days being the usual time.

Symptoms.

These vary in different outbreaks and an attempt has been made to present a composite picture of the disease as it is known to occur in Egypt, Serbia, Galicia and the prison camps of Germany.

The onset may be slight, there being only the discomfort of a mild headache, pain in the back together with a loss of appetite, or it may be sudden and well marked, the patient suffering from cold shivers in addition to the above symptoms, the eyeballs being tender on pressure and there being a sense of lassitude, malaise and faintness. Occasionally general convulsions passing into delirium herald the attack. The period of onset lasts about two days and on the third day the symptoms become aggravated and the true signs of typhus begin to make their appearance. The patient, though he may be going about, has a flushed face and congested eyes. The facies has been described as what might be seen if one could imagine a bad cold in the head without catarrh, *i.e.*, with the secretions suppressed instead of excessive and the tumidity absent. The pulse rate increases while the temperature may still be normal—an important point in early diagnosis.

Epistaxis is frequent in some epidemics and may be profuse and persistent.

There is a general reddening of the skin and what has been termed a "watercourse" appearance is not uncommon, red channels running here and there and combining to form erythematous patches. The conjunctivae may become congested and some nasal obstruction

with slight discharge from the nose may manifest itself. There is no splenomegaly at this stage.

On the second or third day the temperature begins to rise and after a morning remission runs up to 103° to 104°. Its usual course is shown in the charts, the fall being by lysis. There may be a preconvalescent rise.

Cases with remittent temperatures are encountered and these are said to do badly owing to cardiac trouble. The urine is normal. The rash generally appears on the fifth day, being found first on the upper part of the abdomen and spreading thence to the chest and shoulders. The face remains unaffected. The eruption often extends all over the body except the face, but it is more profuse on the trunk, especially on the back. The rash tends to be polymorphic. In a Galician outbreak the following types were in evidence :—

1. Generalised exanthem on the body.
   (a) Small macular type with eruptions of uniform size.
   (b) Large macular type, with various different sized eruptions.
2. Petechial exanthem.
3. Eruption especially developed on the elbow and upper arm, but similar to that on the trunk.
4. Localised on the palms of the hands and soles of the feet, with various clinical forms.
5. Very early-formed small petechiae in pre-existing growths.

The "mulberry" aspect is by no means always present nor indeed is a definite spotted rash. The "watercourse" appearance may persist and there may be an erythema. At the same time the three elements of the "mulberry" can usually be distinguished, namely, the rose pink spots fading to a dirty brown or coppery hue, the subcuticular mottling and the petechiae.

As the rash develops the patient begins to look seriously ill, The headache grows more intense and he sinks into the typhus state, becoming dull and lethargic with sluggish movements and a foul mouth. What with his bloated face and congested skin and eyes he looks as though he were drunk. He is difficult to rouse and lies on his back with a vacant stare on his flushed face and it may be a tendency to squint ; his voice is husky, his hands are tremulous and he is somewhat deaf. His cerebration is slow, he is very thirsty, he can scarcely show his dry, brown tongue and there may be detected the curious and characteristic typhus smell, aptly described as being like a cupboard full of well-blacked boots. There is a certain "tang" in it to which the above simile does justice. The breathing is rapid and there is usually some bronchial catarrh with cough and thin expectoration. In the second week coma, low muttering delirium and retention of urine appear in all but the milder cases. At this stage the urine may contain albumin and casts and the spleen will be found somewhat enlarged. The patient becomes more and more like a log. He is constipated, often

wets the bed and shows signs of cortical irritation such as twitching and hyperaesthesia.

If he is going to recover a change for the better sets in about the fourteenth day, his mind clears and within a week he is hungry and convalescent though weak and flabby. If he is going to die the coma deepens, his tongue continues dry and crusted, the temperature remains elevated or rises and the heart fails. Sometimes a patient will die after the crisis from exhaustion or complications. There is some evidence to show that the virus remains in the body for three weeks after the fever abates.

While the above description is that of a more or less typical case of typhus it must be remembered that there are mild cases without much nervous upset or prostration, cases almost devoid of a rash, fulminant cases with early and violent delirium which perish quickly and what has been called the "high-tension type," with very severe headache and photophobia lasting throughout the entire pyrexial period, no delirium but mental irritability. The pulse is relatively slow but very full and bounding.

Complications.

Hypostatic congestion of the lungs, venous thrombosis, otitis media, parotitis and bed sores and gangrene of the feet may be mentioned. Diarrhœa is sometimes so profuse as to require treatment. The disease may be followed by peripheral neuritis and distressing neuralgias, but the convalescence is usually rapid and complete.

Prognosis.

The majority of cases recover. Those which develop early delirium are very apt to die.

Diagnosis.

As an aid to diagnosis the production of artificial stasis of the vessels is said to be useful. Where the rash is not characteristic or is sparingly developed place a bandage round the arm. The resulting engorgement of vessels shows up the exanthem more clearly and the red maculae can be observed to take on a blue, cyanotic hue, which eventually changes to the brown or coppery colour already mentioned.

Differential Diagnosis.

Typhus has specially to be distinguished from typhoid and paratyphoid, while it may also be mistaken for lobar pneumonia, influenza, cerebro spinal fever, measles, relapsing fever (also lice-borne), plague and septicaemia.

Treatment.

Good nursing is of the utmost importance. The diet should be strengthening and at first should consist of milk, Benger's food, malted milk, Brand's essence and nourishing soups. It is essential

to keep the mouth in a good condition. For this purpose it should be washed out with hydrogen peroxide or some other disinfectant, the throat should be swabbed frequently and the patient encouraged to gargle if he can manage it. A mouth salve of a few drops of Ol. menth. pip. in vaseline is comforting. Stimulation is often required but care must be taken that brandy and strychnine do not aggravate the cerebral condition. Indeed it is better to avoid strychnine in typhus. Digitalis or digitalin ~~are~~ indicated. Camphor is probably the best stimulant to employ. 10 to 20 minim doses of ether subcutaneously have been found useful.

The patient should have abundance of fresh air, be carefully and frequently turned on his side, be given ice to the head and sponged at frequent intervals.

It would seem that morphine, save where definitely contra-indicated, is the most valuable drug in typhus, but it is worth noting that cases have recently been successfully treated by the subcutaneous injection of normal horse serum free of phenol. The dose is 1 c. c., increased if necessary to 3 c. c.

Intravenous administration of typhoid vaccine has been used in Bulgaria and is said to be distinctly beneficial.

A sensitised vaccine has been employed, but this is probably an unnecessary refinement and doses varying from 100 million to 500 million of a stock vaccine might be tried. They are unlikely to do any harm. In cases where there has been much toxaemia together with a low blood pressure the early intravenous transfusion of normal saline has been known to give very satisfactory results.

Prophylaxis.

Some recent work strongly indicates that in quinine we may possess a preventative of real value in typhus. It has been given on several occasions in a daily dose of 3 grains continued for 21 days to persons infected with lice or who have been in contact with typhus cases, and apparently with the happiest results. It is certainly worth a trial. To get rid of lice the use of vermijelli, ~~Oxford powder and~~ the N.C.I. mixture, guaiacol or menthol, is recommended. (See Section on Insect Pests.)

Other prophylactic measures may be briefly indicated. Those in attendance on the sick should be protected from lice by overalls with trousers tucked into gum boots and rubber gauntlet gloves. The overall should fasten closely round the neck. The head should be protected by a close-fitting cap to baffle head lice.

Patients on admission should be carefully washed, the hair of the scalp cut short and treated with *Linimentum saponis* and, where necessary, the hair of the face, the axilla and pubis shaved. Such hair should be collected and burnt. It seems advisable to rub the patient all over with 10 per cent. camphorated oil, or to spray him or rub him down with kerosene, benzine or gasoline. His night-shirt or pyjamas should at first be searched for lice to make sure none have escaped.

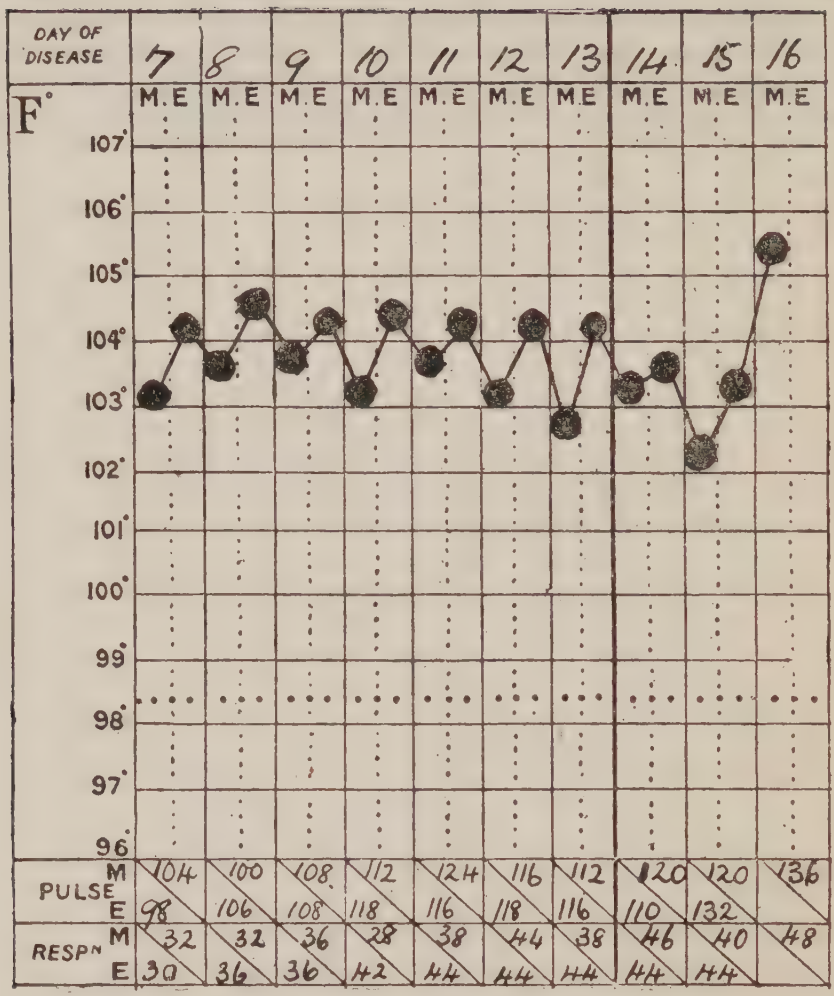
— ∧ or have injection of caffeine /

— Ploetz has prepared a vaccine from his organism & this has been used in treatment, recently an anti-typhus serum has been introduced by Nicolle. So far the reports upon it are distinctly favorable. The daily dose is 10 c.c.

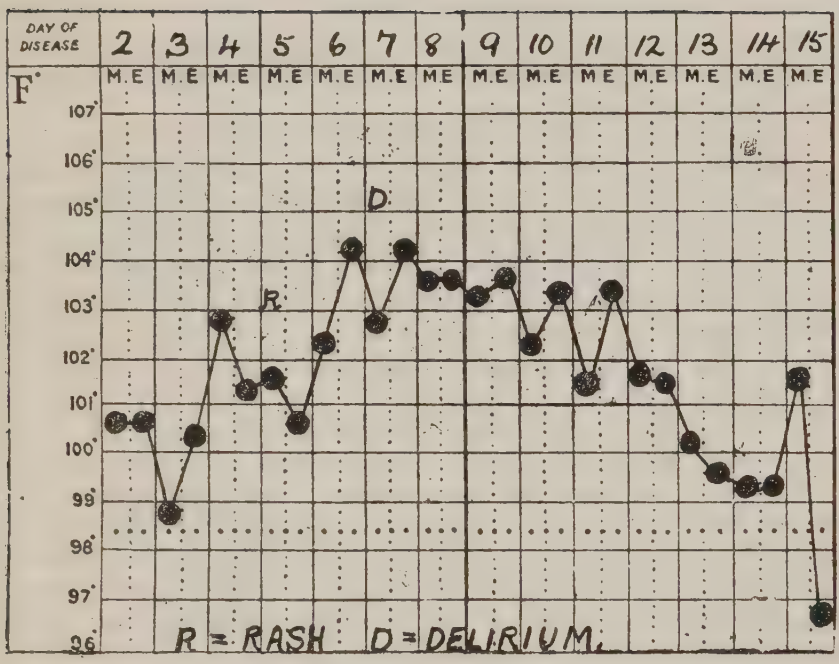
∧ A vaccine prepared by Ploetz from his bacillus ∧ has been tried as a preventive & it is said, with benefit /

— ∧ Birdlime or tangle-foot may be used as lice-traps /

As regards clothes and bedding, it is said that spraying with 10 per cent. formalin is effective, but it is better to rely on the Thresh, or the box or barrel disinfector, which operate by means of current steam. (See Sections on Camp Sanitation and Insect Pests.) Cotton fabrics may be boiled for 10 minutes in water containing 70 grains of carbonate of soda to $1\frac{3}{4}$ pints. It is well to remember that the patient probably harbours the virus for three weeks after the temperature has reached normal and that so far as experimental work has gone there seems reason for believing that the infection is hereditary in the louse. The period of quarantine is 16 days and, to be on the safe side, isolation should continue for 5 weeks.



TEMPERATURE CHART FROM THE SEVENTH DAY OF A CASE OF FATAL TYPHUS FEVER.



TEMPERATURE CHART OF A CASE OF TYPHUS FEVER ENDING IN RECOVERY.

UNDULANT FEVER.

This long continued fever is commonly known as Malta Fever, and has also been termed Mediterranean Fever and Gastric Remittent Fever amongst other titles. It has a wide geographical distribution and is known to occur throughout the eastern Mediterranean. Cases have cropped up amongst British troops operating in this area.

The cause is the *Micrococcus melitensis* and its variety *M. paramelitensis*, minute cocci or cocco-bacilli which are found in the blood and give rise to an acute or chronic septicæmia. Goats are apt to harbour the organism and excrete it in their milk, so much so that the drinking of goats' milk is one of the principal methods of acquiring the disease. As in typhoid, food, fingers and flies are all probably operative in spreading infection for, apart from milk, its products, such as cream and cheese, may harbour the organism; surface soil and dust may become contaminated from the urine of human beings, goats and other ruminants suffering from the disease and so lead to food infection; carrier cases doubtless play a part; and flies may acquire the micrococcus from the urine or fæces. Infection can take place through the skin and mucous membranes.

The urine of ambulant human cases is, during war time, in all probability a special source of danger. The organism is fairly resistant outside the body. It is worth nothing that, in addition to man and goats, cows, sheep, horses, mules and dogs are all liable to natural infection.

Symptoms.

Incubation period of 5 to 15 days followed by headache, insomnia, malaise and anorexia. Constipation is the rule and there is early splenomegaly and tenderness over the spleen. The temperature, of a remittent type, gradually rises, strongly suggesting the onset of typhoid. There may be epistaxis and slight bronchitis and cough with profuse night sweats are not infrequent. The tongue is flabby and coated, with red tip and edges. Even at this stage joint troubles and neuralgia may put in an appearance but they are usually deferred till a later period. After rising for 3 or 4 days by a step-like ascent the temperature falls by a similar descent which reaches normal on or about the tenth day.

The symptoms abate, the patient feels better for a few days but the night sweats and the emaciation, which sets in early, continue and then the first of a long series of relapses manifests itself. (See Chart I.)

During these relapses the joint troubles arise, one joint usually being involved. There is no redness but the part is swollen and there is effusion with severe pain. The condition is transient, lasting a few days but too often re-appearing in another articulation, which not infrequently is the costo-sternal.

At the same time neuralgic pains set in, the peripheral nerves being specially affected and the sciatic often involved.

Albuminuria may be present and orchitis occasionally occurs as a late symptom.

The febrile waves follow each other at short intervals and the disease runs its wearisome average course of 60 to 70 days, which may, however, extend to well-nigh a year. Naturally the patient becomes anæmic, he suffers from palpitation, his pulse is rapid and irregular. Mental depression lays hold of him and it is important to remember that he may become a victim of the morphia habit. His blood shows an increase of lymphocytes and a corresponding reduction in polymorphs.

While this is the usual undulatory fever the disease may be ambulant in type or there may be an intermittent form running a mild course or the attack may be malignant with a high continued fever, pulmonary complications and a tendency to hyperpyrexia. The intermittent form is apt to be puzzling as the morning temperature may be normal or sub-normal and the evening rise slight. Except in the malignant form the ultimate prognosis as regards life is good, only about 2 or 3 per cent. of the cases ending fatally.

Differential Diagnosis.

Save where laboratory facilities are available it is not always easy to diagnose undulant fever. It is apt to be mistaken for typhoid, paratyphoid, sub-tertian malaria, influenza, hepatic abscess, tuberculosis, especially phthisis, and, in certain regions, kala-azar.

The history and careful clinical observation will usually help to clear up the case but in no disease is bacteriological investigation more important.

Prophylaxis.

As for typhoid, special attention being paid to the disinfection of the urine. Isolation of human carriers if they can be found. Boiling of goats' milk, the slaying of infected goats and the avoidance of local products of milk. Personal cleanliness as a preventive is just as important as in typhoid.

Treatment.

Until recently this was entirely symptomatic. Yeast may be tried in 2 drachm doses for the purpose of increasing the polymorphs and reducing the tendency to neuritis. Intravenous injections of starch have been recommended. Cryogenin, as mentioned under Dengue, may be used with care as an antipyretic. Aspirin

5-10 c.c. of a 5 per cent solution of Kahlbaum's starch being employed.

and phenacetin are not over-safe considering the cardiac weakness. Morphia may be necessary but the risk of the morphia habit being acquired in this disease should be remembered. The insomnia has to be combated by the usual hypnotics and cardiac tonics are often indicated. Cold sponging and local anodynes for joint and nerve pains are useful. Depressing drugs such as quinine and the salicylates are harmful.

Though a serum has been tried with some success vaccine-therapy is probably the most promising line of treatment. It is said that ensitized vaccinies act best. In any case the vaccine treatment is best left to an expert and as cases of undulant fever should practically always be sent to England as soon as possible this can be arranged without difficulty.

A chart is given showing the beneficial results of this line of treatment in a couple of cases reported by Fleet-Surgeon P. W. Bassett-Smith, C.B., R.N.

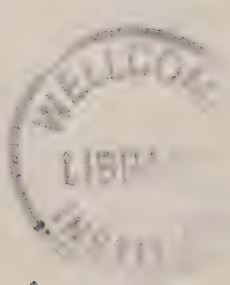
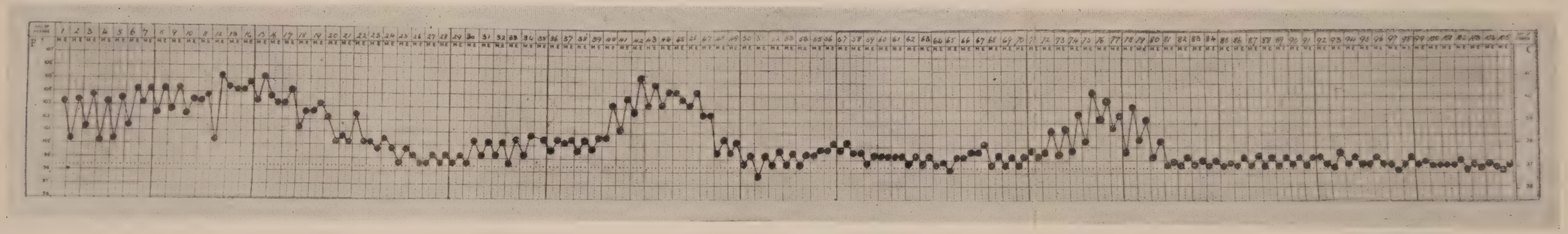


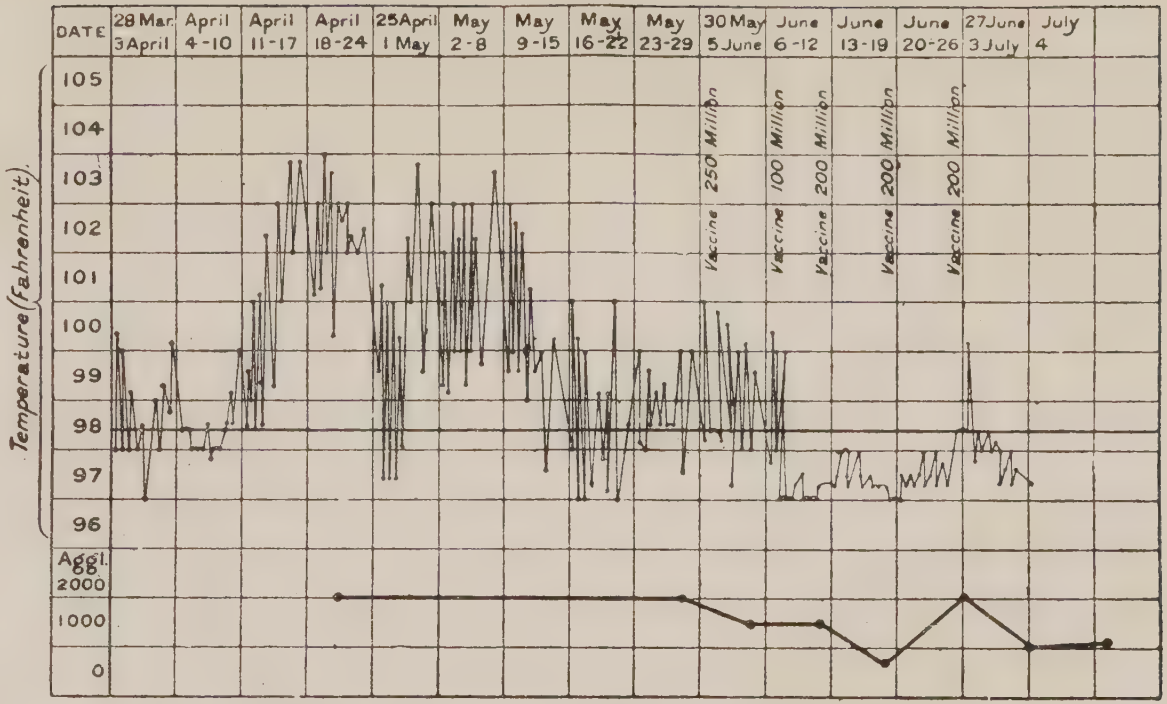
CHART I.



Temperature chart from typical case of undulant fever.

To face p. 134.]

CHART II.



Undulant Fever. Showing temperature and agglutination curves. There was an abrupt termination of the pyrexia after second dose of vaccine and a rapid recovery. Example showing quick reaction to vaccine.

After BASSETT-SMITH.